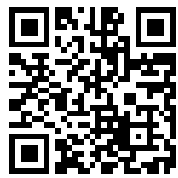
This is a reproduction of a library book that was digitized by Google as part of an ongoing effort to preserve the information in books and make it universally accessible.

Google™ books

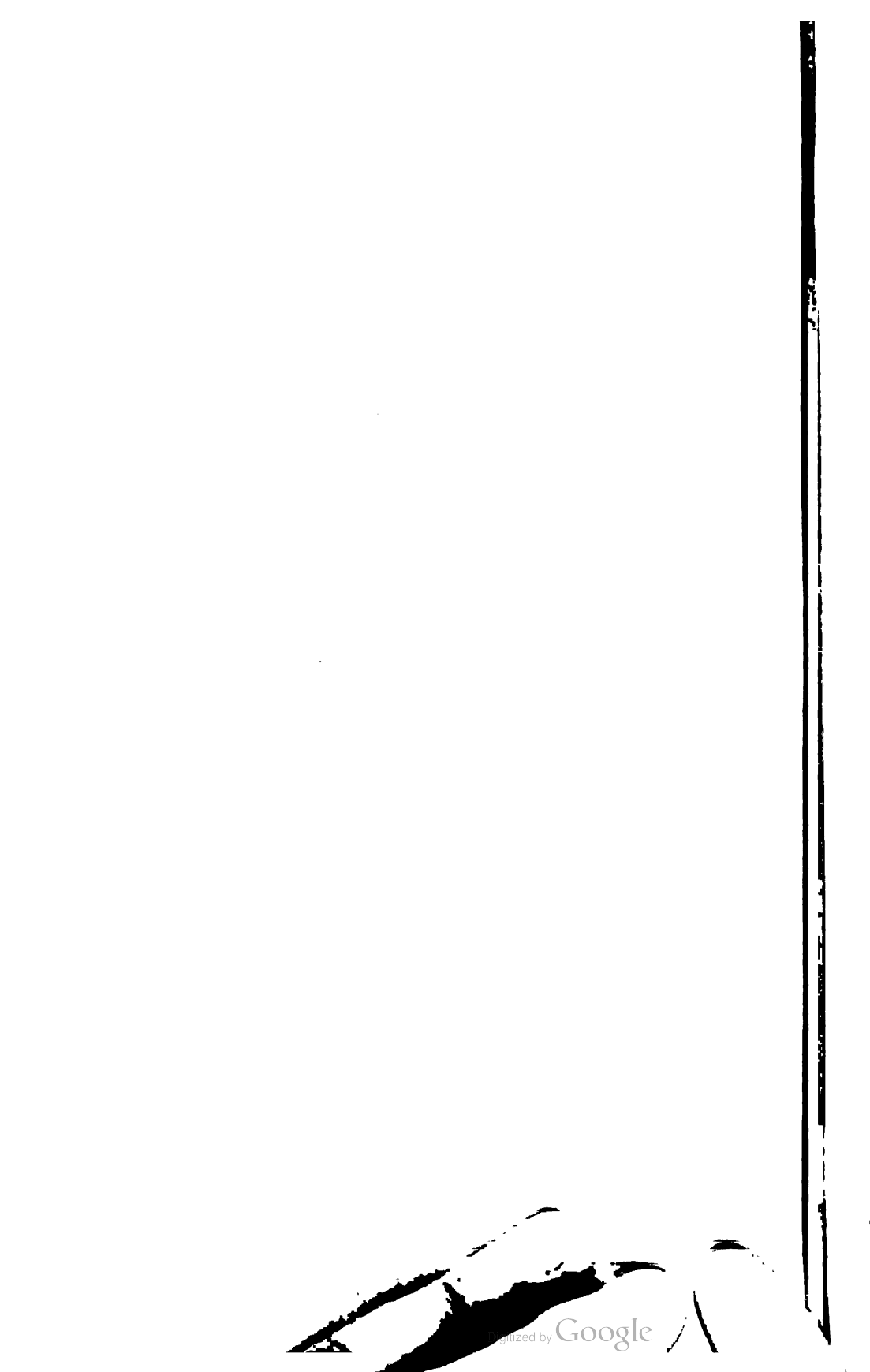
https://books.google.com



Stanford University Libraries
3 6105 119 602 840

Digitized by Google

Digitized by Google


Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

FISCAL YEAR 1978 AUTHORIZATION FOR MILITARY PROCUREMENT, RESEARCH AND DEVELOPMENT, AND ACTIVE DUTY, SELECTED RESERVE, AND CIVILIAN PERSONNEL STRENGTHS

HEARINGS

BEFORE THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

NINETY-FIFTH CONGRESS

FIRST SESSION

ON

S. 1210

TO AUTHORIZE APPROPRIATIONS DURING THE FISCAL YEAR 1978 FOR PROCUREMENT OF AIRCRAFT, MISSILES, NAVAL VESSELS, TRACKED COMBAT VEHICLES, TORPEDOES, AND OTHER WEAPONS, AND RESEARCH, DEVELOPMENT, TEST, AND EVALUATION FOR THE ARMED FORCES, AND TO PRESCRIBE THE AUTHORIZED PERSONNEL STRENGTH FOR EACH ACTIVE DUTY COMPONENT AND OF THE SELECTED RESERVE OF EACH RESERVE COMPONENT OF THE ARMED FORCES AND OF CIVILIAN PERSONNEL OF THE DEPARTMENT OF DEFENSE AND TO AUTHORIZE THE MILITARY TRAINING STUDENT LOADS, AND FOR OTHER PURPOSES

PART 7

Tactical Air

MARCH 9, 10, 11, 14, 15, AND 16, 1977

Printed for the use of the Committee on Armed Services

U.S. GOVERNMENT PRINTING OFFICE

88-379 O WASHINGTON : 1977

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Digitized by Google

COMMITTEE ON ARMED SERVICES

JOHN C. STENNIS, Mississippi, *Chairman*

HENRY M. JACKSON, Washington
HOWARD W. CANNON, Nevada
THOMAS J. McINTYRE, New Hampshire
HARRY F. BYRD, JR., Virginia
SAM NUNN, Georgia
JOHN C. CULVER, Iowa
GARY HART, Colorado
DALE BUMPERS, Arkansas
ROBERT MORGAN, North Carolina
WENDELL R. ANDERSON, Minnesota

JOHN TOWER, Texas
STROM THURMOND, South Carolina
BARRY GOLDWATER, Arizona
WILLIAM L. SCOTT, Virginia
DEWEY F. BARTLETT, Oklahoma
JESSE HELMS, North Carolina
JAKE GARN, Utah

FRANCIS J. SULLIVAN, *Staff Director*
JOHN T. TICER, *Chief Clerk*

SUBCOMMITTEE ON TACTICAL AIR

HOWARD W. CANNON, Nevada, *Chairman*

HENRY M. JACKSON, Washington
SAM NUNN, Georgia
GARY HART, Colorado
ROBERT MORGAN, North Carolina

BARRY GOLDWATER, Arizona
JOHN TOWER, Texas
STROM THURMOND, South Carolina

Digitized by Google

CONTENTS

MARCH 9, 1977

Page

Cannon, Senator Howard, chairman, opening statement 4563
Slay, Lt. Gen. Alton D., Deputy Chief of Staff, Research and Development, accompanied by Maj. Gen. Abbot C. Greenleaf, Director of Programs DCS/P. & R.; Maj. Gen. James R. Hildreth, ACEVAL/AIMVAL Joint Test Deputy Director; Brig. Gen. Robert M. Bond, Deputy Director, Operational Requirements, DCS/R. & D.; Lt. Col. Bob Fay, ACEVAL/AIMVAL Joint Staff, Nellis AFB, Nev 4564

MARCH 10, 1977

Cannon, Senator Howard, chairman, opening statement 4657
Slay, Lt. Gen. Alton D., Deputy Chief of Staff/Research and Development, U.S. Air Force; and Rear Adm. Robert C. Mandeville Director, Aviation Plans and requirements, DCNO (Air Warfare), U.S. Navy; accompanied by Maj. Gen. Abbott C. Greenleaf, Director of Programs, DCS/P. & R.; Brig. Gen. Robert M. Bond, Deputy Director of Operational Requirements, DCS/R. & D. and Brig. Gen. Kenneth A. Smith, Assistant Deputy Chief of Staff for Air Headquarters, Marine Corps .. 4657

MARCH 11, 1977

Slay, Lt. Gen. Alton D., Deputy Chief of Staff for Research and Development; Rear Adm. Robert C. Mandeville Director, Aviation Plans and Requirements, DCNO (Air Warfare); and Brig. Gen. Charles E. Canedy Deputy Director of Requirements, and Army Aviation Officer, Office of Deputy Chief of Staff for Operations and Plans, accompanied by Maj. Gen. Abbott C. Greenleaf, Director of Programs, DSC/P. & R., USAF; Maj. Gen. Timothy I. Ahern, Assistant Deputy Chief of Staff/Research and Development, USAF; Brig. Gen. Robert M. Bond, Deputy Director of Operational Requirements, DSC/R. & D., USAF; Capt. Michael G. Basford, Head, Budget and Legislative Section, DCNO (Air Warfare), USN; and Capt. James H. Eckart, Head, Aviation Electronic Warfare Section, DCNO (Air Warfare), USN 4740

MARCH 14, 1977

Miller, Lt. Gen. Thomas H., U.S. Marine Corps, Deputy Chief of Staff for Aviation, Headquarters, U.S. Marine Corps, Accompanied by Rear Adm. R. C. Mandeville, Director, Aviation Plans and Requirements Division, DCNO (Air Warfare); Rear Adm. E. R. Seymour, U.S. Navy, Deputy Commander, Plans and Programs, Naval Air Systems Command; Capt. Mike G. Basford, U.S. Navy, Head, Budget and Legislative Section, Aviation Plans and Requirements Division, DCNO (Air (Warfare); Col. Stanley P. Lewis, U.S. Marine Corps, AV-8 Weapon System Program Manager, PMA-257, Naval Air Systems Command; James P. Darr, Director, Procurement Budget Division, Naval Air Systems Command: Col. John V. Cox, U.S. Marine Corps, Head, Plans and Readiness Branch, Aviation Department, Headquarters, U.S. Marine Corps; Col. Clayton L. Comfort, U.S. Marine Corps, Head, Air Weapons Systems Branch, Aviation Department, U.S. Marine Corps; Lt. Col. Richard M. Morley, U.S. Marine Corps, Head Reconnaissance Section, Air Weapons System Branch, Aviation Department, Headquarters, U.S. Marine Corps; Maj. Lawrence E. Reed, U.S. Marine Corps, Head, Budget Review Section, Plans and Readiness Branch, Aviation Department, Headquarters, U.S. Marine Corps 4832

Digitized by Google

Doyle, Vice Adm. J. H., Jr., U.S. Navy, Deputy Chief of Naval Operations, Surface, Warfare; Accompained by Rear Adm. W. H. Rowden, U.S. Navy, Director, Surface Combat Systems Division, Office of Chief of Naval Operations; Rear Adm. E. W. Carter, U.S. Navy, Deputy Commander, Weapon Systems Engineering Directorate, Naval Sea Systems Command; Rear Adm. W. E. Meyer, U.S. Navy, Aegis Project Manager, Naval Sea Systems Command: Capt. T. R. Mathis, U.S. Navy, ASMD Project Manager, Acting, Naval Sea Systems Command; Capt. R. R. Hatch, U.S. Navy, Director, Medium-Range Missile Systems Division, Naval Sea Systems Command; Comdr. G. R. Meinig, U.S. Navy, CIWS, Phalanx, Project Manager, Naval Sea Systems Command; and Comdr. A. S. Mobley, U.S. Navy, SIRCS Project Manager, Naval Sea Systems Command ..... Page 4871

MARCH 15, 1977

Milford, Hon. Dale, Congressman from Texas, 24th District 4976
Turner, Vice Adm. F. C., U.S. Navy, Deputy Chief of Naval Operations (Air Warfare) 4978

MARCH 16, 1977

Slay, Lt. Gen. Alton D., Deputy Chief of Staff, Research and Development, U.S. Air Force 5140
Lindsay, David, developer of the Enforcer Aircraft, and J. Lynn Helms, president, Piper Aircraft; accompanied by Paul Lovington, Lycoming Division of AVCO, and W. A. Baker, chief engineer, Bristol Composite Materials, Ltd 5141

Digitized by Google

MILITARY PROCUREMENT, FISCAL YEAR 1978

WEDNESDAY, MARCH 9, 1977

U.S. SENATE,
SUBCOMMITTEE ON TACTICAL AIR
OF THE COMMITTEE ON ARMED SERVICES,
Washington, D.C.

AIR TO AIR MISSILE PROGRAMS

The subcommittee met at 9:15 a.m., pursuant to recess, in room 224, Russell Senate Office Building, Senator Howard W. Cannon, chairman presiding.

Present: Senators Cannon and Goldwater.

Also present: Charles Cromwell, Robert Q. Old, Will Ball, and Edward Kenney, professional staff members; and Frank Krebs of Senator Cannon's office.

OPENING STATEMENT BY SENATOR HOWARD CANNON, CHAIRMAN

Senator CANNON. Today the subcommittee will review the Air Force and Navy air-to-air missile programs. These missiles fall into three distinct categories: small, short range, dogfight missiles; the intermediate range all-weather missiles; and the very long range interceptor missiles.

Our hearing this morning will follow this general format. First, we will hear about the special AIMVAL/ACEVAL test program to define the follow-on to the 9L version of the Sidewinder, then we will have a status report on the 9L, next we will review the AIM-7F Sparrow and the monopulse Sparrow, and then will have the Phoenix long-range missile, and finally will cover R. & D. improvements for air-to-air guns, ramjets, and the general R. & D. technology program.

Our principal witnesses today are Lt. Gen. Alton D. Slay, Deputy Chief of Staff/R. & D. and Rear Adm. Robert C. Mandeville, Director, Aviations Plans and Requirements, DCNO (Air Warfare), and they are accompanied by Maj. Gen. Abbot C. Greenleaf, Director of Programs, DCS/P. & R., Rear Adm. E. R. Seymour, Deputy Commander, Naval Air Systems Command, and the program managers for the various weapons systems.

Now, General Slay, you may start this morning's hearing.

Digitized by Google

STATEMENT OF LT. GEN. ALTON D. SLAY, DEPUTY CHIEF OF STAFF RESEARCH AND DEVELOPMENT, ACCOMPANIED BY MAJ. GEN. ABBOTT C. GREENLEAF, DIRECTOR OF PROGRAMS DSC/P. & R.; MAJ. GEN. JAMES R. HILDRETH, ACEVAL/AIMVAL JOINT TEST DEPUTY DIRECTOR; BRIG. GEN. ROBERT M. BOND, DEPUTY DIRECTOR, OPERATIONAL, REQUIREMENTS, DCS/R. & D.; LT. COL. BOB FAY, ACEVAL/AIMVAL JOINT STAFF, NELLIS AFB, NEV.

General SLAY. Mr. Chairman, we first have Lt. Col. Bob Fay, who is on the ACEVAL–AIMVAL Joint Staff at Nellis Air Force Base, Nev.

AIMVAL–ACEVAL PROGRAM

PREPARED STATEMENT OF LT. COL. BOB FAY

Good morning. I am Lieutenant Colonel Fay, and I am assigned to the ACEVAL–AIMVAL Joint Staff at Nellis Air Force Base, NV.

I wish to introduce Rear Admiral Tissot, Joint Test Director, who is dual-hatted as the Commander of COMFITAEWWINGPAC, San Diego. Major General Hildreth, who is Rear Admiral Tissot's deputy and also the Deputy Commander of the Tactical Fighter Weapons Center at Nellis AFB. Also with the Test Director and his Deputy is Captain Russell Davis, who is the Joint Test Coordinator.

We are conducting test operations with a staff of some 800 Navy, Air Force, and Marine officers and enlisted personnel, along with several contractors, and are permanently assigned to Nellis AFB.

The test is underway. We are here to give you a brief review of the purpose and scope of these tests and to describe our progress to date.

PROGRAM OVERVIEW

- ACEVAL
  - EVALUATE AIR-TO-AIR COMBAT FACTORS
  - DEVELOP INITIAL DATA BASE WITH CURRENT WEAPONS
  - PACED BY NEEDS FOR FIGHTER FORCE SIZING MODEL
- AIMVAL
  - DEFINE REQUIREMENTS FOR FUTURE SHORT RANGE AIR-TO-AIR MISSILES
  - EVALUATE FIVE INFRARED (IR) CONCEPTS
  - PACED BY DEVELOPMENT LEAD TIMES

Both ACEVAL and AIMVAL are designed to evaluate air-to-air combat factors, but in two distinctly different areas. ACEVAL is to develop an initial data base with current weapons—the AIM–7F, the AIM–9L, and gun—so we can begin to develop a fighter force sizing model that we, the Services, OSD, and the Congress can use. AIMVAL focuses at future requirements for short-range, air-to-air missiles. We are evaluating five IR missile concepts to determine those characteristics in sensitivity and off-boresight that can be usefully employed.

Our goal, along with the Services and OSD, is to finalize the results and make a recommendation to Congress in fiscal year 1979.

Digitized by Google

VISUAL AIR-TO-AIR COMBAT FACTORS

- RELATIVE AIRCRAFT PERFORMANCE
- RELATIVE WEAPONS SYSTEM CAPABILITIES
- ENCOUNTER RATIO/SIZE
- INITIAL CONDITIONS
- TACTICS
- PILOT SKILL AND AGGRESSIVENESS

These are the six major influencing factors affecting the outcome of visual air-to-air combat. The degree by which these six factors influence is the primary purpose of ACEVAL. We tend to grasp relative aircraft performance and weapon system capability as the key factors in air combat because they are quantifiable. We, in AIMVAL, are applying short range weapon system capabilities while allowing the remaining factors to play.

We tend to address the influence of numbers in terms of large air battles of a war. ACEVAL tries to quantify flight size (1, 2 and 4 aircraft) battles as a stepping stone from the 1 V 1 situation.

Initial conditions, tactics, and aircrews bring in the human factor. Another purpose of ACEVAL is to investigate and quantify initial conditions.

We are finding in the test that tactics play a major role and we are attempting to address the relative impact in the data.

We would like to assure you we have highly intelligent, skilled and aggressive aircrews on both sides.

TEST OBJECTIVES

ACEVAL	AIMVAL
EVALUATE THE FACTORS WHICH AFFECT THE OUTCOME OF MULTIPLE AIRCRAFT ENGAGED IN CLOSE-IN AIR COMBAT BETWEEN SPECIFIC AIRCRAFT:	COMPARE THE OPERATIONAL UTILITY OF EXISTING AND PROPOSED SHORT-RANGE AIR-TO-AIR MISSILE CONCEPTS:
– FORCE SIZE/RATIO	– SENSITIVITY
– INITIAL CONDITIONS	– OFF-BORESIGHT

These, then, are our test objectives. ACEVAL is looking at the factors which affect the outcome, with particular emphasis on the numbers and initial conditions. We only go to a 4 versus 4 mock combat situation due to instrumentation limitations.

Digitized by Google

In AIMVAL, we would like to re-emphasize that we are comparing operational utility and not conducting a detailed R.D.T. & E. testing of specific hardware. AIMVAL focuses on conceptual seeker sensitivity and off-boresight target acquisition capability.

Because of support costs, we must do AIMVAL first. However, during AIMVAL, we also accomplish part of our ACEVAL objectives using the same methodology.

After two months of actual testing, we are approximately two weeks behind schedule.

CONCEPT OF TESTING

- BASED ON INSTITUTE FOR DEFENSE ANALYSIS (IDA) DESIGN CRITERIA
- F-14 OR F-15 (U.S. FORCES) VERSUS F-5E (THREAT FORCE)
- IR CAPTIVE TEST UNITS FOR ACQUISITION
- REALISTIC MOCK COMBAT ON INSTRUMENTED RANGE
  - ENCOUNTER CONDITION UNCERTAIN
  - WEAPON COUNT
  - TACTICAL OPTIONS
  - PROBABILITY OF KILL
  - INTRUDER AIRCRAFT

ENGAGEMENTS CONSTRAINED TO VISUAL IDENTIFICATION ENVIRONMENT

The concept for this operational test is based upon the Institute for Defense Analysis' design criteria to accomplish [deleted] confidence in the results. OSD has contracted directly with IDA for this effort.

The F-5E is the common threat [deleted] postulated for the 1985 time frame. We have built captive test units to actually acquire the target so as to give a measure of the capabilities of varying seeker sensitivity. The difference between this test and the normal service training missions is that we are attempting to keep the combat conditions unpredictable. We do restrict the aircraft to the numbers of missiles and rounds of ammunition they would normally employ in combat.

The F-14 does not employ the Phoenix missile in this test.

Each side, red and blue, employs tactics as they see the combat conditions evolve at that time.

We are also using specific probabilities of launch, guidance, and kill which, when multiplied together, using varying conditions, give you a range of probabilities of kill.

We also use intruder aircraft to insure the engagements are constrained and the shooting starts only when one side has visually identified the enemy.

Digitized by Google

SCOPE OF TESTS

- AIR SUPERIORITY FIGHTERS ENGAGED IN MOCK AIR COMBAT
- ADVANCED THREAT/CURRENT FRIENDLY CAPABILITY
- WITHIN VISUAL RANGE
  - RELATIVE ADVANTAGE AT VID RESULTS FROM AIRCREW DECISIONS AS INFLUENCED BY INITIAL CONDITIONS
- EVALUATING WEAPON SYSTEM EFFECTIVENESS
  - INTERPLAY OF BLUE RADAR/IR/GUN SYSTEMS, AIRCREWS, INITIAL CONDITIONS, AND TACTICS MATCHED AGAINST RED
- MEASURING RELATIVE OPERATIONAL UTILITY OF IR CONCEPTS
  - LETHALITY AND SURVIVABILITY FACTORS
- AIR COMBAT TACTICS/PROCEDURES DEVELOPED BY AIRCREWS (TWO SIDED)

We would like to further amplify the scope of the tests and to give you a better picture of our tests at Nellis.

The F-14 and F-15's are being used in the air superiority role, going against other fighters in the same role. We are not using as a measure of merit for these fighters, terms such as numbers of bombers killed, formations broken up, or airfields bombed. We are focusing on kills and losses of air superiority fighters going against other air superiority fighters.

In order to determine future air-to-air requirements, we have significantly advanced the threat capability in terms of equipping it with an all-aspect IR missile that is optimized against the F-14 and F-15. This is a basic assumption which should be understood to keep the results in perspective. The advanced threat also includes factors such as free play tactics and highly trained aircrews. The current friendly capability is essentially the basic F-14 and F-15 using independent attack techniques and highly trained aircrews.

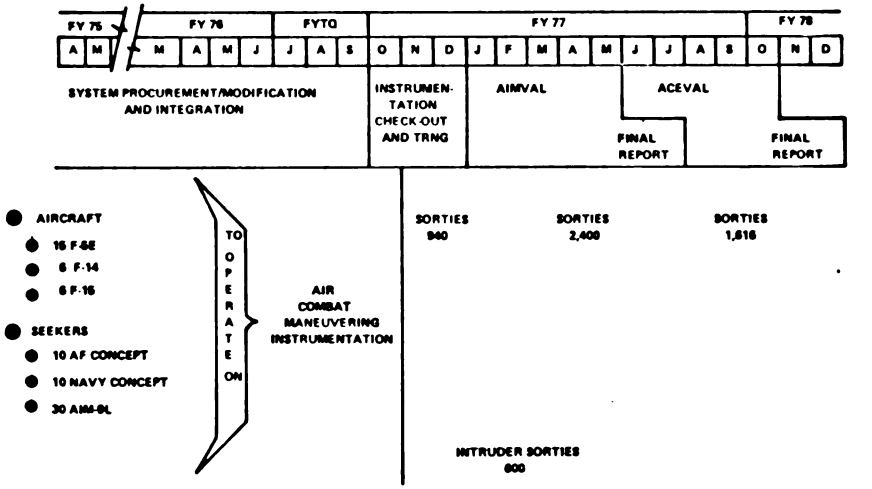
Once again, the fight is constrained to the visual environment. The visual identification point starts the shooting; however, the relative advantage at the start of shooting results from aircrews employing their weapon systems in combination with GCI and positional advantages.

In order to get a look at the true factors and the relative operational utility of the IR missiles, you are forced to look at total weapon system effectiveness. Survivability is a driver in this test due to the implementation of real time uncertainty factors.

The tactics are being devised by the aircrews on a mission-by-mission basis and not directed by higher headquarters or technical agencies. We will attest that this test is indeed two-sided.

Digitized by Google

ACEVAL-AIMVAL



This is the same chart we showed you last year.

We have met our schedule and are now testing the concepts. The only change we have made was to start our check-out and training phase twelve days early.

The system is working and we have developed a data management system to accommodate a large amount of data outputting from this intensive flying schedule.

(4-minute movie shown that will reflect AIMVAL sorties flown during concept C testing.)

ANCILLARY BENEFITS

- ANALYSIS MAY PROVIDE SIGNIFICANCE OF:
  - SIMPLE VERSUS COMPLEX WEAPONS SYSTEMS
  - ONE VERSUS TWO COCKPITS
  - VISUAL TARGET ACQUISITION SYSTEM (VTAS) (NONE, 1 OR 2)
- UPDATE OF AIR-TO-AIR COMBAT SIMULATIONS/MODELS
- SERVICE COORDINATION ON:
  - CONCEPT IMPLEMENTATION
  - END GAME RESEARCH
  - SIMULATION TECHNIQUES

Through subjective and quantitative data, insight could be provided on the simple versus complex weapon systems issues.

We have seen the aircrews utilizing tactics to maximize advantage and minimize disadvantages in these areas. Through the employment of visual target acquisition systems on helmet mounted sights in the 2-cockpit F-14, we may see a measure of utility by equipping the rear seat aircrew member of the F-14 with the capability to slave and fire weapons systems.

Digitized by Google

Both services' technical and analytical communities will be using the AIMVAL data to update their models and simulations to give an even better estimate. There is active Service coordination on whether the concepts can be implemented, and looking deeper into the end game and simulation techniques.

SUMMARY

- **DATA BASE CHARACTERISTICS**
  - **AIRCREW IN LOOP**
  - **COMBAT WEAPONS OPTIONS**
  - **TACTICS FREEPLAY**
  - **INITIAL "CONDITIONS" VERSUS "SETUP"**
  - **AIMVAL**
    - **COMMON DATA BASE**
    - **DEFINE MISSILE CHARACTERISTICS**
  - **ACEVAL**
    - **PROVIDE EXTRAPOLATION PROCEDURES FOR SPECIFIC A/C**
    - **DEVELOPMENT OF BASELINE DATA**

We are underway to address the test objectives. We have have the aircrew in the loop; they do have the options, tactics is a major player, and they are not given set-ups once they enter the 30-mile circle. We are providing common data to both Services, who are using it in an expanded operational and technical analysis.

We are not flying off missile concepts but attempting to define suitable and operationally usable missile characteristics in terms of sensitivity and off-boresight.

In ACEVAL we are attempting to answer the question, "how can you extrapolate from the 1 versus 1 situation to the 4 versus 4, and what is the confidence in that data?"

ACEVAL/AIMVAL R. & D. OBLIGATIONS—PROGRAM COSTS
[In thousands of dollars; fiscal years]

	1975 (actual)	1976 (actual)	19TQ (actual)	Subtotal through 19TQ	1977 (estimate)	1978 (estimate)	Total estimated cost
Total	5,344	22,983	4,646	32,973	9,544	416	42,933
Funding sources:							
PE 65804D	1,485	14,316	135	15,936	3,684	416	20,036
PE 25564N	3,859			3,859			3,859
PE 63305N		4,270	3,719	7,989	3,039		11,038
PE 63315F		1,390		1,390	2,720		4,110
PE 64735F		3,007	792	3,799	101		3,900

ACEVAL–AIMVAL R. & D. OBLIGATIONS—PROGRAM COSTS

The fiscal year 1978 costs are the same as we forecasted in our last briefing to this committee. The total program cost of $42,933K is up by $963K over last year's testimony. This was primarily due to increased and unforeseen spares and support costs, plus product improvements for the captive test units.

At the end of the fiscal year TQ period, we have spent $32,973K to mod the aircraft, build the captive test units, and to modify the ACMI.

The fiscal year 1977 costs are for support of these items while we are testing.

Digitized by Google

The fiscal year 1978 costs will allow us the one month of flying in fiscal year 1978, to write the final report, and to terminate the program.
This concludes our briefing. Are there any questions?

CAPABILITIES OF 9L SIDEWINDER

Senator CANNON. What have you learned in these tests now about the capabilities of the 9L Sidewinder missile on the AIMVAL-ACEVAL?

Colonel FAY. We have seen it on the film, sir. The primary capability of the 9L is the all-aspect capability. It has revised the tactics quite a bit. We find it quite a capable weapon [deleted].

IMPACT ON DOGFIGHT TACTICS

Senator CANNON. How does it affect the tactics? What do you have to do?

Colonel FAY. [Deleted.]

Senator CANNON. How does this affect the use of the Sparrow missiles in the engagement?

Colonel FAY. It complements the Sparrow very nicely, sir. The Sparrow is an all-aspect missile, too.

Senator CANNON. Could you use the same tactics with respect to the Sparrow?

Colonel FAY. [Deleted.]

Senator CANNON. Are there many gun firing opportunities? You showed one here. Do you get a lot of them?

Colonel FAY. No, sir. We are investigating AIMVAL data to find out these opportunities also. We have just completed the "C" concept, sir and there were not too many gun firings. I could not even give you a percentage off the bat in terms of opportunities or how many one side shot down.

LESSONS LEARNED ON F-14 AND F-15

Senator CANNON. What have you learned from the testing with respect to the F-14, the F-15, and the F-5E capabilities?

Colonel FAY. One of the most surprising things, considering the newness of the blue aircraft, is the capability to generate sorties; they are very maintainable airplanes. All the other data, sir, are so preliminary right now, the F-15 radar is working super [deleted].

But they have employed their radars and avionics capability to a degree that we can foresee great benefits in terms of [deleted]. Both sides in a visual arena see each other about the same time at the same distance apart. [Deleted.] One other example I can give you on the capability of the systems. We start the trial and within [deleted]. That is a pretty fantastic capability.

Senator CANNON. How much of the AIMVAL test has been completed to date?

Colonel FAY. We have completed Charlie concept which is the 9L. That is the baseline missile from which we make comparisons with the other four "IR" missile concepts. We are roughly considering the concept completed. We are roughly one-third of the way through.

Digitized by Google

PURPOSE OF ACEVAL

Senator CANNON. Your statement this year says that the purpose of ACEVAL "is to develop an initial data base so that we can begin to develop a fighter force sizing model." That is a different statement than was given to the subcommittee last year when the purpose was stated to be "evaluate the factors which affect the outcome of multiple aircraft engaged in close air combats between specific aircraft." Will you explain what that current statement of purpose means and give its origin?

Colonel FAY. We are investigating the effect of numbers, sir, in ACEVAL as we stated last year. The 1 V 1 force mix to the 4 V 4 and other various force mixes will get a better handle on what happens in an air battle in terms of the numbers. The joint test force will not be extrapolating from that but there are a lot of agencies within the Navy and Air Force that will be using the data to improve their air combat models which do play the numbers game.

Senator CANNON. Well, the situation where one or the other has GCI available is incident to the particular location where you might be. Do you see any need for aircraft or weapons system changes under conditions of whether you do or whether you don't have GCI?

Colonel FAY. I am not too sure I understand the question, sir.

Senator CANNON. Here you give GCI to one side, or the other, on different occasions. Whether you have GCI depends on the particular theater where you are operating, as to which side has it. Are you saying that you have the optimum aircraft and the optimum missile, dependent on whether you do or whether you don't have GCI?

General SLAY. Let me try to answer that. We have theoretically taken a big skyhook and dropped these airplanes into a 30-mile arena. We don't allow the F–14, for instance, to take full advantage of its [deleted] radar and Phoenix. So it is a canned situation. The reason it is canned is that we are evaluating the missile concept rather than the fire control systems and the aircraft themselves, although in the arena that we are in, that small constrained arena, we do see what the system the aircraft and the radar can do. But we don't allow either the F–15 or the F–14 to take full advantage of its total system. If we did that we would skew the results that we want to get. We are actually looking for the best concept for a close in missile. If we allow the Phoenix to operate or the F–15 to operate outside of that arena, we would skew the result and we would be afraid that we would not get the answers that we want.

RULES OF ENGAGEMENT

Senator CANNON. Is that your reason for the 30-mile restriction?

General SLAY. No, sir, that is a physical restriction of the ACMI, itself. Whether it is greater or lesser, what we really want is that final close in engagement after a visual identification. That is one of the ground rules that may not have come through very clearly. We have to have a visual identification before the engagement starts. In that way it is canned.

Senator CANNON. I thought on one of those it indicated that they did not have visual identification.

Digitized by Google

General SLAY. No, sir, that is always a requirement.

Colonel FAY. GCI cannot provide, to the air crews, friend or enemy determinations. The air crew must go in there, usually identify the aircraft before he can shoot.

General SLAY. [Deleted.] We don't allow that.

Senator CANNON. When they start initially they don't know whether it is friend or foe?

General SLAY. No, sir.

Colonel FAY. We do more than that. We put in intruder aircraft which are friendly. If you shoot down the intruder it is a bad day if you are the aircrew. For example, we run the F–4's against the F–5E to make sure the F–5E pilots are honest. We use A–4's or A–7's against the blue aircraft, very similar in size to the enemy but they are different.

General SLAY. That is to make it absolutely positive that you do have a positive ID before you shoot. Again I want to make it very clear that we are looking at only a small little ball of air space and the air battle and we are doing that deliberately to test out the concept of the short-range, close-in maneuvering dogfight missile.

EFFECT OF AIRCRAFT NUMBERS ON RESULTS

Senator CANNON. Is this test adequate now to test the mix that you need, what you need in the way of airplanes? Do you need more of one or more of another?

General SLAY. You mean in the close-in engagement?

Senator CANNON. Yes.

General SLAY. Once you get in that close-in engagement, yes, sir. In a free play exercise where we would allow the F–14 to take full advantage of the total system, the result might be totally different. So I would hesitate to draw a final conclusion from what we are doing here on whether you need one F–14, two or four.

Bob, would you like to add to that?

Colonel FAY. It is strictly within the visual arena.

Senator CANNON. What are your maximum test numbers in any particular engagement?

Colonel FAY. We go up to a four versus four, sir. We are not doing four versus four in AIMVAL.

General SLAY. One thing that did not come through clearly enough, blue never outnumbers red. Red either outnumbers blue or is the equivalent of blue. We never have two blues versus one red or four blues versus one red. It is always the reverse. That again is deliberate to set it in the condition that we will be operating over in Europe where we will be outnumbered.

Senator CANNON. Is this adequate to give you a valid test to extrapolate when you get into higher numbers?

Colonel FAY. You bring command decision into the higher numbers. C–3 plays quite a role.

General SLAY. The biggest problem you have in many versus many is traffic control, who is going to shoot down whom, and how you do it and what tactics you use. There is no way you could extrapolate from two versus two up to many on many in a real melee. You can draw conclusions and certainly it will point you in a particular direction but in

Digitized by Google

order to come up with real firm conclusions you have to have more of a free play exercise and you have to bring your command and control into it such as AWACS.

Senator CANNON. What about the airplanes? Do you see a need for more of an advanced threat airplane in this operation?

General SLAY. Sir, we went into this knowing that the F–5E with the Sidewinder L is going to be an absolutely formidable threat. We don't project the Soviets to have anything like that until into [deleted]. It is a tough, tough threat, about as tough as we are going to face before [deleted]. That was deliberate. We didn't want to design a missile to be operational in the eighties against a threat that we have today. That is the reason we gave the F–5 the all aspect missile.

STATUS OF 9L AND FOLLOW-ON

Senator CANNON. Would you say that you are pretty well pleased with the AIM–9L so far?

General SLAY. You are right. It is a tremendous missile.

Senator CANNON. Do you see any need to be moving beyond it at the present?

General SLAY. Beyond the 9L?

Senator CANNON. Yes.

General SLAY. Yes, sir. We have not gotten to the test yet, that is, the other concept in testing how much off-boresight we need. Another thing we want to find out, as an example, is if the small missile, which would theoretically be a cheap missile, has the capability to do essentially what the AIM–9L does today. Maybe it wouldn't be a good buy or maybe it would be a good buy.

If you can get the small missile a lot cheaper, maybe that is the way to go. Or, if you take the large off-boresight missile that is inherent in the Navy concept and it turns out that that missile is killing them right and left against the Sidewinder concept, we will have a way to go, also. But that is the object of the exercise, to tell two things: No. 1, do we have in these two concepts, missiles that are better than the Sidewinder L; No. 2, between the two concepts which is the better way to go? We don't rule out the fact that the results of the test might say go both ways. That may be the most cost-effective way. We don't know that. We don't really expect that, but we certainly wouldn't rule that out.

ACCURACY OF SIMULATIONS

Senator CANNON. Are you satisfied with the accuracy of your computer programs and the instrumentation?

Colonel FAY. Yes, sir. We have a very fine data management system. We essentially turn the data in 8 hours from each management. We validate it in terms of the accuracy of the data. We have constant checks on the accuracy of the instrumentation and we output it to the services and to the Institute of Defense Analysis.

Senator CANNON. How is the airplane actually configured? When a man fires what happens?

Colonel FAY. I am sorry you could not see it too well on the screen, sir. When he fires the computer—do you mind if I put up a slide, sir?

Senator CANNON. All right.

Digitized by Google

Colonel FAY. When the air crew perceives a target and when he wants to shoot a weapon, he depresses the trigger. The instrumentation looks out there to see if there is a target, also matches the seeker-look angle, the off-boresight degrees, and things like that. We roll the dice, if you will, against a probability of launch. If the random number is below the probability of launch and the missile is sent flying in real time in a computer, this missile looks at all these limits. For example, the Sun could capture the seeker head during the flight, or in sufficient velocity. If it bumps against one of those limits the missile misses. Once it goes by the target, a tenth of a second to go, it checks the miss distance. All this time the missile is flying against the target. It has nothing to do with the shooting aircraft except in the case of the 7F which must maintain a radar lock. We pull out a number, a percentage like 0.6, and then roll the dice again to determine the probability of kill. If he gets a kill it is so indicated to him. We inform the pilot if he is killed or was killed by UHF radio from test control at Nellis Air Force Base.

Senator CANNON. Does he break off then?

Colonel FAY. Yes, sir. On the ACMI his call sign is pulled up on the right side and we drop a box on him and he is told to get out of the flight. He rocks his wings and goes off.

General SLAY. What Bob is saying, Mr. Chairman, is that we do the best we can, once the button is pushed, to fire the missile. It might not happen that way if we were actually firing the missile because there are so many constraints that you have to assume and put into the computer. As he says, it is sort of a Monte Carlo operation when you get down to whether you actually get a kill with that missile or not. But it is the best we can do with the simulation that we have.

AIMVAL AND ACEVAL OBJECTIVES

Mr. CROMWELL. I get the impression from listening to the briefing and the discussion back and forth this morning, that you and the test force and also General Slay and Admiral Mandeville, feel that the purpose of AIMVAL is going to be accomplished in these tests. In other words, the tests are realistic enough that you will be able to sort out these differences in missile concept, and what they do for you operationally. Speaking for the test force, do you feel that that is a valid assessment of what you are telling us?

Colonel FAY. I believe we will achieve the test objectives, yes, sir. We showed the six factors in the beginning to give to you an understanding that is not going to be a simple task to sort out of here the exact contribution of off-boresight and seeker sensitivity. That is just one of six factors we have going in this test. I mentioned the word tactics, that we are seeing an impact of tactics. We find out when we put in our different sensitivities, different off-boresight, the tactics do change as the air crews try to make maximum use of the weapons systems. It is not just blue changing: red changes, too. But we will be able to give the contribution of, we believe, off-boresight and seeker sensitivity in terms of an operational utility standpoint to the Services who will then come up with a position.

Digitized by Google

General SLAY. That is the tester's way of saying we would like to have about five times as many sorties as we have under our belt to come up with a conclusion, and that is correct. But within the constraints of the program, and it is an awfully expensive program now, from an Air Force viewpoint I agree with what you said. I think we will do a good job of coming up with some conclusions. Those conclusions are not straightforward. You have to add a lot of things to what he showed you to start with, that have to be considered. But I feel that the basic data that is coming out of these tests is going to give you an infinitely better handle on the decision that we, jointly with Congress, have to make on which is the best way to go.

Mr. CROMWELL. Do the artificialities imposed on the test, in other words, putting the airplanes within a 30-mile circle, knowing that there will never be more than four of the enemy in the sky and so forth, restrict the validity of the AIMVAL part of the program?

Colonel FAY. Restrict it in terms of extrapolating beyond that capability, yes, sir, of course.

Mr. CROMWELL. I am speaking of AIMVAL and trying to determine the utility of different kinds of missiles.

Colonel FAY. We believe the test is well designed for a short-range air-to-air missile test which is basically a visual environment, yes, sir.

Mr. CROMWELL. Admiral Tissot?

Admiral TISSOT. I think we can do this. The test won't be perfect at all. We have our artificialities. We come the nearest to actual combat in this very ambitious test of any we have ever had before. The pilots are aggressive. They are the best pilots in either service. If we could fire real missiles we could give an exact answer. I think this test will give us insight much deeper than we have ever had to make our judgment. Certainly the results will not be perfect, the constrained environment, blue being outnumbered. But I think this is the best test we have had of this type.

Mr. CROMWELL. I am not criticizing the fact that there are test artificialities. I am trying to get a straightforward statement of whether or not you believe they are going to artificially skew the results such that you, the operational pilots, will not be able to say, yes, this is good, or no, that is bad. Given the fact that, yes, there are some constraints, do you still believe you can come up and analyze these missile concepts?

Admiral TISSOT. Yes; I think we can.

PILOT REPORT ON RESULTS

Mr. CROMWELL. Will pilots that are involved in this program be making a pilot report, or operational report?

Admiral TISSOT. Yes; they will to their services.

Colonel FAY. In two areas. One, in JTF the document on the test report and the other through the services.

Mr. CROMWELL. That is fine as to reporting to your own service, but what I am looking for is to find out whether or not there will be the traditional operational evaluator, OPTEV for kind of report where the pilots sit down and say, "here is what we did, here is what we

Digitized by Google

believe is valid and here are the constraints we think ought to be placed on the results, and this is why they don't necessarily apply to the real world and real war." Are you specifically tasked to write that kind of report?

Colonel FAY. Yes, sir.

General SLAY. It would not be very valuable without it, Mr. Cromwell.

EXTRAPOLATION OF ACEVAL RESULTS

Mr. CROMWELL. Working from AIMVAL into ACEVAL, as the pilot flying in the program, what do you feel about the ability to extrapolate ACEVAL to a real war where there might be 20 or 30 or 50 airplanes out in a much larger arena? Aren't the constraints of putting four airplanes, four on four, in a 30-mile circle a little less valid for extrapolation to larger number sizes, to draw conclusions about larger numbers?

Colonel FAY. That is correct, sir. It would be less applicable. It would not be very appropriate to take the 4 V 4 result and try to extrapolate to 8 V 8. What you have to visualize is how many dogfights can you expect in such an environment.

Mr. CROMWELL. I certainly hope you as the operators are going to write this report and place those kinds of warnings on extrapolating ACEVAL data. I frankly can't see much purpose in ACEVAL. You are going to test 4 on 1, 4 on 2. My gosh, it is intuitively obvious if you have the choice of outnumbering the other guy you would just as soon outnumber him. It would seem like a trivial finding, the ACEVAL part of the program.

Senator CANNON. I don't agree with the counsel's analysis of that, myself.

General SLAY. Col. Ted Twinting is here from D.D.R. & E. and he perhaps should defend himself.

Colonel TWINTING. In the past we have been able to match one airplane versus another and then based upon the results of that simple engagement attempted to make judgments of 2 on 4, 4 on 4, the validity of that comparison is in doubt and the activity in ACEVAL will provide us qualitative information of whether or not a 1 versus 1 encounter can be interpreted as the result of a 4 on 4. We don't know that answer. ACEVAL will determine that.

Senator CANNON. It will give you an answer within those rather narrow parameters. When you get to the bigger numbers, that gets into what General Slay was talking about. That involves a lot of other problems, command and control problems primarily, when you get into your big number areas. Is that correct?

Colonel TWINTING. Yes, sir.

Senator CANNON. Do you agree with that, General Slay?

General SLAY. Absolutely. I certainly agree with it because I said it.

Sir, let me go back to Mr. Cromwell's question. They are very perceptive and direct to the point questions. One of the dangers of this entire test is that the results will be misconstrued and people will not remember that this is a 30-mile piece of the sky that is very constrained and we are not letting the F-15 or the F-14 act as they nor-

Digitized by Google

mally would. We are requiring artificiality in the way the engagement is initiated in order to test the concept.

We want to do precisely what Mr. Cromwell said and make sure that the operational pilots lay it on the line in that report and say the constraints under which we operated ought to be clearly understood. Quite frankly trying to extrapolate the results of AIMVAL to a melee over East Germany would be extremely dangerous. The only thing we are going to be able to extrapolate is the individual, I won't call it an end game, but the almost end game to an end game with that kind of missile. You can extrapolate that. That is about all you can extrapolate. You can't draw too many conclusions on the overall air battle. I guess that is the thing that I am afraid people will try to do, Mr. Cromwell, and we don't want them to do that.

Mr. CROMWELL. Yes, sir; and taking up from that point, I can appreciate what Colonel Twinting said, that perhaps artificial conclusions have been drawn in the past from 1 on 1. Then having gone on to do 4 on 4, you know, you still have an artificial situation. I guess we are in sync, we are more or less agreeing that having gone from 1 on 1 to 4 on 4 you still don't have anything in terms of going on to 40 on 40 or 40 on 20?

Senator CANNON. At least you are not projecting everything from the basic 1 on 1 situation. You have gone beyond that point in your actual testing.

General SLAY. In order to keep this from sounding like a tremendously insurmountable thing, we have to do an extrapolation eventually and defending Ted a little bit more here in the ACEVAL, we would anticipate that even though it is 40 on 40, that the way this air battle will take place will probably be 4 on 4 or 4 on 8 or a more constrained piece of the sky than just everybody mixing it up, although we certainly don't rule out that you will have that kind of melee. The Israelies did. They had large melees with gangs of airplanes all involved. Certainly we can see that as a potential outcome. But another potential outcome is that people will sort of choose up sides in flights of four versus flights of four perhaps.

PURPOSE OF TESTS

Senator GOLDWATER. Has the purpose of ACEVAL and AIMVAL changed and possibly been more closely defined?

Colonel FAY. Yes, and no, sir. I am sorry to give you an ambivalent answer. The basic purpose of ACEVAL are the test objectives we have shown. We found, as we started testing, a lot more factors may play on the outcome. We are investigating those types of things.

Senator GOLDWATER. Why do some people feel the AIMVAL program was not required?

Colonel FAY. I can't address that question.

General SLAY. Let me attempt it, Senator Goldwater. You can start with the cost. It is a very expensive program. There are people whose judgment I respect who have asked, "Are you going to get $43 million worth of data out of this test?" And that is a hard one to answer. You

Digitized by Google

have to answer it from a judgment basis. My personal judgment and the judgment I think of most people involved is, "Yes, it is going to be worth the $43 million." We can't quantify that yet but we know just on what we have seen thus far that at least that part of our judgment is right, that we are gaining a whole lot, not only in testing the concepts of the missile but in sorting out what it is we are going to face when we face an all aspect threat. We are learning a lot about tactics and we are learning a lot about how to get into and out of an air battle. So that is valuable in itself. But you really can't put a quantified value on it. I feel that another reason that someone might have said that AIMVAL is not required is that you can assume all these things in an analysis fashion and put all of the characteristics of the aircraft and all of the characteristics of the missile is a computer, kick that computer and have it spit out a roll of tape that tells you what the outcome was. We have been doing that for years. But it leaves out an extremely important factor and that is the human factor and unless you have that human factor in there, by golly, Senator Goldwater, as far as I am concerned you don't have much. I am not an analysis man, my self. I would rather do it myself.

Senator GOLDWATER. I could not agree with you more, and speaking of cost, do you know what the cost has been to date and how much we are going to need to complete it?

General SLAY. Admiral Tissot could answer that, he is the test director.

Admiral TISSOT. The cost to date has been about $35 million. The appropriated money we desire is included in General Lotz's line element, in the D.D.R. & E. test and evaluation.

Senator GOLDWATER. Is it correct to say that nothing really new has come from this program?

General SLAY. Not yet, sir. I think probably that is an overstatement. We have confirmed the fact that, yes, an F–5E with an all-aspect missile is a very formidable threat. We have confirmed that our tactics have to be different if we are facing that kind of threat than if we were facing an atoll-type threat we have today. We knew that going in. Perhaps Bob Fay could answer that better than I. What have we found new?

Colonel FAY. I would say the new thing is the all-aspect threat. [Deleted.]

General SLAY. Everyone makes that comment but nobody offers a solution as to how you do that in a mixed up engagement. [Deleted.]

[Deleted], you certainly don't want to shoot down "blue four" coming in on a different flight of your own.

Senator GOLDWATER. I agree with you. It may be expensive but we have had a lot of programs that were expensive that we learned something out of.

General SLAY. Yes, sir.

Senator GOLDWATER. We can put any problem we have in a computer if you want to do that but you can't get that guy sitting up there, making his own mind up, in a computer. I hope you go ahead with this. I have watched this test out there and I am very impressed with it.

Digitized by Google

OBJECTIVITY OF TESTS

It has been alleged that overall ACEVAL has lost its objectivity and service interests and contractor interests have become dominant; is that right?

General SLAY. If that is true, I want to turn in my suit. That is the thing we have to avoid. If any service bias gets into these test results we ought to fire Admiral Tissot, me, Bob Mandeville, and everybody else. We cannot have that. I would be surprised if contractor influence is creeping in there. We want to avoid that. I will say this absolutely on the record. Admiral Tissot has the full responsibility to assure that this does not happen and to so conduct that test and to so write that report in a totally unbiased and totally nonservice-oriented fashion that we just avoid that. Otherwise we are nowhere. We have wasted that money.

Senator GOLDWATER. You say that you are applying short range weapons systems capabilties while allowing the remaining factors to play. What do you mean by that?

Colonel FAY. Sir, we showed that chart with the six factors that influence outcomes in visual air-to-air battles. We are varying two of those six factors in Aceual, but in Aimval we are also varying weapons systems capabilities to look at the offboresight and seeker sensitivity.

Senator GOLDWATER. You still have an interest in offboresight capability?

Colonel FAY. That is our test objective.

Senator GOLDWATER. You are going to have to keep that too?

Colonel FAY. Yes, sir.

Mr. OLD. Colonel, I still don't believe I quite understand that. Quoting from the text of your briefing it says "we in AIMVAL are applying short range weapons systems capabilities while allowing the remaining factors to play."

Colonel FAY. Yes, sir.

Mr. OLD. The remaining factors then relate to those six points.

Colonel FAY. Yes, sir. Of course the F–15 and F–14 is a constant in the test in terms of aircraft. ACEVAL looks at these two things. We did that during the concept "C." We allow free play tactics once they get inside the 30-mile area. We have pilots, we don't change them out, so the pilots are fairly well trained in their skill. In AIMVAL we do vary the weapons system capabilities which is the short range IR missile capability.

Mr. OLD. With the five versions?

Colonel FAY. Yes, sir.

Mr. OLD. Thank you very much.

COMMON REQUIREMENTS FOR FOLLOW-ON MISSILE

I would like to ask one further question on AIMVAL and ACEVAL just to keep in the sequence. Yesterday, Navy Secretary Marcy said in his statement that—

*** * * at the conclusion of the current AIMVAL test we expect to enter into a joint project with the Air Force to develop the next generation of "within visual range" missiles.**

Digitized by Google

That is the end of the Secretary's statement. Do you interpret that statement to mean that Navy is confident that it can agree with Air Force on a common "within visual range" missile?

Admiral MANDEVILLE. Yes sir. That was the intent there, that we think we will end up with the same within visual range missile. We may end up with two. That certainly can't be ruled out at this time. We feel pretty confident that the requirement probably will drive us to the same missile.

General SLAY. If we do end up with two, in that unlikely event it would not be a Navy and Air Force concept, it would be two missiles for the Air Force and two missiles for the Navy. It is a dual requirement. They will still be joint and jointly used.

Mr. OLD. You both seem to be more confident this year than at least General Slay was last year that the possibility of settling on one missile is a little stronger.

General SLAY. Perhaps that was a fair comment. I was confident last year. I am more confident now than perhaps I was then.

Senator GOLDWATER. Will this Sidewinder-9L be compatible to the Air Force and Navy? You did have trouble firing it. You did not fire the same missile from the same aircraft?

General SLAY. Those were the old Sidewinders. This new AIM-9L is the same. Identical except for the cooling bottle that we put in.

Senator GOLDWATER. You don't have to modify the racks to launch them?

General SLAY. No, sir. The AIM-9L that we have is exactly the same for the Navy and the Air Force. There is no problem on compatibility. We could borrow Navy missiles and fire them from our airplanes, but we have to add the cooling bottle.

Senator GOLDWATER. How about your launchers, are they compatible?

General SLAY. Yes, sir.

Senator GOLDWATER. Can the Air Force F-4 launch a Sidewinder from the Navy?

General SLAY. You are thinking of the LAU-7A launchers that the Navy has versus the launchers we have. They are different. It is just that the Navy has a shoulder mount for their AIM-9L's where they can carry air to ground in the same rack. We have to have a different arrangement on our F-4's the way our racks have been built. The racks will be different, the launchers will be different.

Senator GOLDWATER. How much of a job would it be to change that?

General SLAY. We have looked at the potential of using the Navy rack on our F-4's, sir, not rack but pylon. We lose. We lose all the WRM stocks and pylons and launchers that we already have bought. We have a full complement of that on our systems now. The type launcher on the F-16 will be totally different from the launcher on the Navy F-18.

Senator GOLDWATER. Don't you think it would be desirable to have them compatible or interchangeable?

General SLAY. Yes, sir. As far as F-4J and F-4E are concerned, yes, sir, no question. I don't think we could ever make the F-18 launcher compatible with the F-16 launcher because they have a different way

Digitized by Google

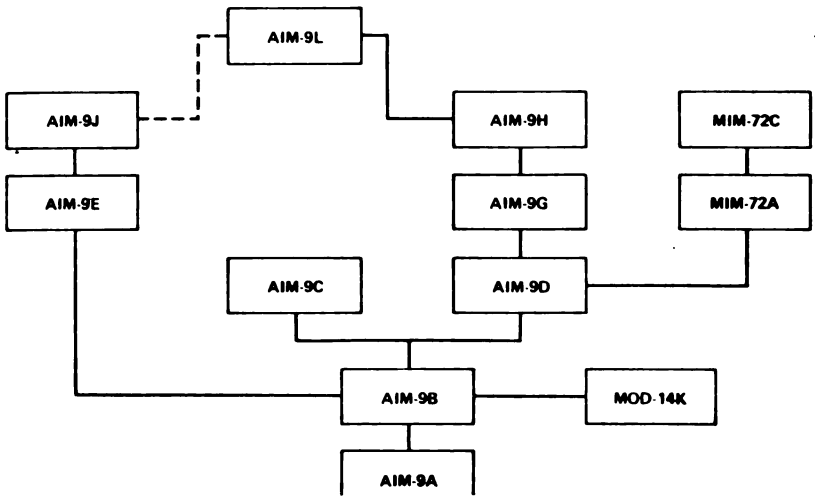
of hanging it on the airplane, or F–14 and F–15, they have a different way. Certainly if we had it all to do over again and we were starting to built the F–4 from scratch and building the F–4E from scratch we could make those launchers compatible.

Senator GOLDWATER. You may proceed.

SIDEWINDER PROGRAM REVIEW

Captain VAN DYKE. Good morning, I am Capt. Will Van Dyke, Sidewinder project manager in the Naval Air Systems Command. Lieutenant Colonel Hansult, the Air Force AIM–9L program director in our office is also present. The AIM–9L is a joint Navy-Air Force program with the Navy as executive service. This briefing will primarily concern the AIM–9L.

SIDEWINDER FAMILY TREE



This slide traces the development of the Sidewinder family of missiles. The Air Force missiles are the AIM–9E and AIM–9J, while the Navy currently has the AIM–9G and AIM–9H in service. The U.S. Navy AIM–9H production will be completed in August 1977. Production for approved foreign military sales cases will continue through November 1977. Additional cases that have been offered may extend the production for an additional year. The MIM–72A and C are Army ground-launched Chaparrals and the MOD–14K is a German modification of the AIM–9B. The AIM–9L brings the Navy and Air Force back together with use of one short-range air-to-air missile for both services. There are advantages in both production and in support costs by the use of a common weapon.

Digitized by Google

ASSETS/STATUS

AIM-9B	NAVY	OUT OF SERVICE
	AIR FORCE	
AIM-9D	NAVY ONLY	OUT OF SERVICE
AIM-9E	AIR FORCE ONLY	3479
AIM-9G	NAVY ONLY	2076
AIM-9H	NAVY ONLY	3420
	TO BE DELIVERED BY AUG 77	700
AIM-9J	AIR FORCE ONLY	4671
AIM-9L	NAVY	800
	AIR FORCE	710

This slide shows the status of the various versions of the Sidewinder. The AIM-9B and AIM-9D are obsolete and out of service. About 700 AIM-9H missiles remain to be delivered. Only the initial first-year procurement of AIM-9L missiles is shown. The total planned buy is 14,950 missiles.

The Navy inventory is close to meeting the objective of [deleted] missiles. It shows the mixture of AIM-9G's, AIM-9H's and planned AIM-9L's in the inventory. The Air Force and Navy operating units will receive their first AIM-9L's in May 1978.

This slide shows the Air Force inventory requirements and the mixture of AIM-9E's, AIM-9J's, and planned AIM-9L's. The Air Force has considerably increased their AIM-9L planned production buys in fiscal year 1978 and fiscal year 1979 so as to meet their inventory requirements in 1980 and beyond.

This picture points out the general configuration of the AIM-9L and compares it to its predecessor, the AIM-9M. The rocket motor and the wings are the same for both missiles. The warhead and fuze were new developments for the AIM-9L, but were also procured for the fiscal year 1975 buy of AIM-9H's. The guidance control sections are 60 percent common and the manufacturing processes are similar.

The next two slides show the major changes of the AIM-9L over the AIM-9H and the improvements provided by these changes. The seeker is changed from lead sulfide to indium antimonide to provide the forward hemisphere launch capability. The AM conical scan provides the sensitivity required while the FM portion gives a more stable tracking point at close range. The rate bias provides a stable tracking point against targets in afterburner. The seeker will track the tailpipe/exhaust interface. The larger canards give a higher missile "G" capability allowing a shorter firing range at a maneuvering target.

Digitized by Google

IMPROVEMENTS

- **AIR BOTTLE**

- **ACTIVE OPTICAL FUZE** deleted

- **ANNULAR BLAST FRAGMENTATION WARHEAD**

This is the first missile with an air bottle internally mounted allowing it to be used with either Navy or Air Force launchers. The precise burst control of the active fuze is required for the all-aspect capability, and is not available with previous fuzes. The blast-fragmentation warhead puts higher velocity fragments on the target.

This slide demonstrates the significant improvement in the AIM–9L envelope has over that of the AIM–9H. The target is in the center and is a MIG–21 not in afterburner. The blue and orange area is the 9L firing area whereas the 9H can only be fired in the blue area. The fighter will no longer have to maneuver to the stern of the target due to the large area forward of the target beam in which he can fire.

RELEASE OF TECHNOLOGY OF 9L SIDEWINDER

Senator GOLDWATER. The large area is your improvement?

Captain VAN DYKE. AIM–9L can be fired in orange or blue whereas the 9H can only be fired in the blue. It shows the tremendous increase in capability.

General SLAY. I might interrupt at this point and say that that slide and the results of the AIMVAL test thus far is one reason why both the Navy and the Air Force have been very, very picky about releasing this kind of technology. We don't want the bad guys to have it.

Senator GOLDWATER. Have you released it to Germany?

Captain VAN DYKE. Yes, sir, we have released the data package without the fuze.

Senator GOLDWATER. Do you have any indication that the Soviets have gotten one of these?

General SLAY. [Deleted.]

Mr. OLD. General Slay, what are the ramifications of releasing the missile or selling the missile to the Germans less the fuze? What does that do? Is that the statement that was made?

General SLAY. That was the statement. That was the position taken by the Navy.

Bob, you perhaps are better qualified to answer that.

Digitized by Google

Admiral MANDEVILLE. The fuze was held at the last ditch maneuver, being the latest development we had in the missile. Of course the guidance itself, seeker sensitivity, gives it the all aspects. With another fuze in there it will not function as well. That is why the fuze data package is held back.

Mr. OLD. Isn't the guidance technology in the all aspect ratio, so to speak, in the AIM–9L the technology involved here?

Admiral MANDEVILLE. Yes, sir.

Mr. OLD. Why would somebody tell the committee that by holding back the fuze we are not giving away the technology.

Admiral MANDEVILLE. You need the precise burst control of the fuze that we have, to give it the all aspect capability.

Mr. OLD. Is it possible for them to come up with that part of it?

Admiral MANDEVILLE. Yes, sir.

Mr. OLD. Who made the judgment as to what part of this technology to release?

Admiral MANDEVILLE. Department of Defense, Department of State.

Mr. OLD. Thank you.

Senator GOLDWATER. Say they don't have the fuze and they have a situation where they need it, how long will it take us to get them the fuze?

Captain VAN DYKE. We have said we will sell them the fuze but we will not give them the data package so that they can produce it. Obviously they can reverse engineer it.

Senator GOLDWATER. They have a rather useless weapon if they need it in a hurry.

Captain VAN DYKE. Yes, sir.

Admiral MANDEVILLE. They will buy it. They will have the fuze but they just don't have the data package. In other words, they will have to figure out how to make one. They will have it in their missiles, the Germans will.

General SLAY. They will be able to manufacture everything, sir, except the fuze. The fuze they will buy already made.

Senator GOLDWATER. How long will it take to get it to them?

Admiral MANDEVILLE. We will have them there when they have their first missiles ready to come off the line.

Senator GOLDWATER. That is the State Department position?

General SLAY. Yes, sir.

Senator GOLDWATER. That explains it. I can't understand it. That is a silly thing.

Captain VAN DYKE. This shows the position from which the Techeval and I.O.T. & E. shots were fired relative to the target in the center. As can be seen, the all aspect capability of the missile has been well demonstrated. The envelope superimposed on this chart only represents one target condition. It is only there to generally represent the shooting area.

Senator GOLDWATER What general ranges are we talking about there?

Captain VAN DYKE. 4,000 feet.

Senator GOLDWATER. The circles are 1,000 feet?

Captain VAN DYKE. This is the 4,000-foot circle and here is the 8,000-foot circle.

Digitized by Google

IOT&E GUIDANCE PERFORMANCE

(DCP CRITERIA: 85% GUIDANCE SUCCESS)

- 28 FIRED*

deleted

* EXCLUDES ONE NO-LAUNCH

The initial operational testing was completed in January last year. Twenty-eight missiles were fired in I.O.T. & E. Two of the no tests were fired inside minimum range and two were fired without the missile locked on the target. One of the two failures was refired successfully. The performance of the missile has been excellent. [Deleted] of the successful shots were direct hits. In addition there were [deleted] shots from the F–15 which were all direct hits. There have not been any additional firings in the past year.

The fuzing performance has been outstanding, with only one failure due to the failure of a thermal battery. Two of the four no tests were caused by telemetry failure and in the other two no tests the missiles impacted in the target before the fuze function could be observed.

Digitized by Google

PROGRAM MILESTONES (AIM-9L)

JAN 76	DSARC III
	• APPROVED PRODUCTION
	• FOLLOW-ON TEST & EVALUATION
APR 76	GUIDANCE SECTION CONTRACT (RAYTHEON)
	• 1510 MISSILES
JUN 76	DCP-90A APPROVED
SEP 76	FUZE (AOTD) SECOND SOURCE CONTRACT
	• MARTIN SELECTED

The AIM-9L DSARC III was held in January 1976. The decision memo approved the recommended program and required follow-on test and evaluation of production missiles to confirm expected captive flight reliability prior to full production and fleet introduction. The initial contract was signed with Raytheon in April 1976 for 1,510 missiles for Air Force and Navy use. The governing DCP was approved in June of 1976. In an effort to reduce fuze cost and provide a mobilization base Martin Marietta was selected as the second source producer.

PROGRAM MILESTONES (AIM-9L)

APR - 77	FIRST ARTICLES DELIVERED
JUN - 77	GUIDANCE SECTION CONTRACT TO SECOND SOURCE - FORD
AUG - 77	COMMENCE FOLLOW-ON TEST & EVALUATION
APR - 78	INCREASE PRODUCTION RATE

deleted

Digitized by Google

The first article guidance control sections under the Raytheon contract will be delivered in April. Ground reliability testing on these units will be performed in May and June. In June we also expect to sign a contract with Ford Aerospace as second source for the guidance sections. In August 1977 we will begin the flight testing of the Raytheon guidance sections to confirm the expected captive carry reliability. This should be completed in early February 1978 in order to release the contractor to high rate production in April 1978. The initial operational capability [deleted] will be based on delivery of the low rate production missiles.

PROCUREMENT COST ESTIMATES
COMBINED NAVY/AIR FORCE PROGRAM

($ MILLIONS)

FY	76/TQ	77	78	79	80	81	82
QUANTITY	1510	1420	2900	3010	3150	1840	1320
PROC. COST (ESCALS)*	93.0	90.4	143.7	125.2	118.9	66.9	57.8
PROC. UNIT COST	.062	.064	.050	.042	.038	.041	.044

* ESCALATED DOLLARS APPLYING OSD INDICES AND EXPENDITURE PROFILE (INCLUDES SPARES)

The total planned procurement of AIM–9L missiles for the Navy and Air Force is 14,950. This chart does not include any foreign military sales. The procurement costs in escalated dollars using OSD indices are shown along with the procurement unit cost. Both the Navy and Air Force plan to procure the missile through 1982.

DESIGN TO COST

- UNIT FLYAWAY DESIGN TO COST GOAL

  (AVERAGE OVER PROGRAM)

  $34.7K 13,236 UNITS FY-76 DOLLARS

- CURRENT ESTIMATE

  $34.1K 14,950 UNITS FY-76 DOLLARS

Digitized by Google

The unit flyaway design to cost goal established for this program is $34,700 based on last year's planned quantities of 13,236 units. This is in constant fiscal year 1976 dollars. The current program quantity is 14,950 units, and our current unit flyaway cost estimate is $34,100.

FY 78 BUDGET AIM-9 PROCUREMENT ($M)

	76	TQ	77	78	79	80	81	82
USN								
AIM-9H SUPPORT	4.8	0.8	2.7	2.2	1.0			
AIM-9L	47.1		34.0	38.2	33.0	32.0	30.4	31.7
TOTAL	51.9	0.8	36.7	40.4	34.0	32.0	30.4	31.7
(QTY)	(800)		(420)	(600)	(650)	(650)	(640)	(620)
USAF								
AIM-9L	45.9		56.4	105.5	92.2	86.9	36.5	26.1
(QTY)	(710)		(1000)	(2300)	(2360)	(2500)	(1800)	(700)

NOTE: FUNDING FOR SPARES IS INCLUDED IN THE ABOVE DATA, BUT MODIFICATION FUNDING IS NOT.

This slide separates the Navy and Air Force requirements and funding. It also includes the Navy AIM-9H support which was not shown on the previous slide. The Air Force has significantly increased their quantities in 1978 (up from 1,376), 1979 (up from 1,220) and 1980 (up from 1,190).

COST OF 9L MISSILE

Senator GOLDWATER What will your total program cost be?

General SLAY. Air Force program unit cost in then year dollars is $44,000 apiece. In 1977 dollars, $39,000.

Captain VAN DYKE. Do you want unit cost or total program?

General SLAY. $44,000.

Senator GOLDWATER. You used to pay about $37,000 for a P-51.

General SLAY. Could we escalate that to 1977 dollars?

Digitized by Google

PRODUCT IMPROVEMENT

GUIDANCE CONTROL SECTION

OBJECTIVE: IMPROVE PERFORMANCE WITHOUT LIFE CYCLE COST INCREASE

CHANGES:

IMPROVED IRCCM
IMPROVED BACKGROUND DISCRIMINATION
IMPROVED TRACKING RATE
REPACKAGE ELECTRONICS
ELIMINATE POTTED CORDWOOD MODULES
CLOSED CYCLE COOLER

INCORPORATE IN FY-81 PRODUCTION

Captain VAN DYKE. The AIM–9L development was completed in 1976, but since a follow-on dogfight missile is not close at hand it is worthwhile pursuing a program to upgrade the AIM–9L capabilities. The primary emphasis is on an improved counter-countermeasure capability and on improved background discrimination.

An improved tracking rate and an effort to repackage the electronics to eliminate the potted cordwood modules is also part of this program. To eliminate the logistic requirements to recharge the missile air bottle, a closed cycle cooler is also being pursued. This is an adaption of the cooler designed for the Maverick missile. These improvements are planned to be incorporated in the 1981 production following operational test and evaluation.

PRODUCT IMPROVEMENT

FUZE (ACTIVE OPTICAL TARGET DETECTOR)

OBJECTIVE: REDUCE LIFE CYCLE COST & MAINTAIN PERFORMANCE

CURRENT UNIT COST - $7000
COST GOAL - $4000

CHANGES:

REDUCED NUMBER OF CIRCUIT BOARDS
CAST VICE MACHINED STRUCTURE
PLASTIC OPTICS

INCORPORATE IN FY-79 PRODUCTION

Digitized by Google

We are also pursuing an effort on the active optical fuze to reduce its cost. There is no change in performance involved as the fuze performs its function well. The current unit cost is $7,000 in 1976 dollars and we expect to reduce this to about $4,000 with some of the producibility changes shown. We plan to incorporate these changes in the fiscal year 1979 production. In addition to the fuze and guidance section changes, a low smoke motor effort is being pursued.

PRODUCT IMPROVEMENT FUNDING

	76	TQ	77	78	79	80	81	TOTALS
NAVY								
PE 25664N (WAA31)	1.7	.8						2.5
PE 64354N (POM-78) (WO456)		.6	2.2	3.3	4.4	4.4	.8	15.7
AIR FORCE PE 27161F			.2	2.6	2.5	.4		5.7
								23.9

The product improvement funding is shown here. It was started under the AIM-9L development project element and later funded under the component engineering element.

AIM-9L FOREIGN MILITARY SALES

GERMANY

- COPRODUCTION MEMORANDUM OF UNDERSTANDING DRAFTED
- PRODUCTION TECHNICAL DATA PACKAGE PROVIDED (LESS FUZE)
- SALE OF 500 MISSILES IN PROCESS

UNITED KINGDOM

- LETTER OF OFFER FOR 1709 MISSILES

Foreign sale of the AIM-9L has been closely controlled. One thing not pointed out in the earlier discussion, we have a pending sale of 500 missiles to Germany. These are separate from giving them the data package and also selling them a fuze.

Digitized by Google

Senator GOLDWATER. Is Iran buying these?

Captain VAN DYKE. They have a request in for AIM-9Hs but there is a possibility they will change to AIM-9L's.

General SLAY. We have a moral commitment with the four consortium countries with the F-16 to sell them the "L" also. We have not addressed that. I think it is an obligation for selling them. They are our partners with the F-16, and they will probably want the "L."

Senator GOLDWATER. Does Israel have this weapon?

General SLAY. No, sir.

SUMMARY

- AIM-9L WITHIN COST GOAL
- AIM-9L PRODUCTION SLIGHTLY BEHIND SCHEDULE
- PRODUCT IMPROVEMENT ON SCHEDULE

Captain VAN DYKE. They have AIM-9G's. In addition the United Kingdom has requested the AIM-9L missiles. In summary, the AIM-9L production program is progressing smoothly within its cost goals and essentially on schedule. The AIM-9L product improvement program is also on schedule.

Senator GOLDWATER. Mr. Cromwell, do you have any questions?

RELIABILITY OF MISSILES

Mr. CROMWELL. Well, do you have an updated status on the reliability of the 9L in production. The 9H was getting 550 hours mean time between failures. I know you hope to do as well with the 9L. Do you have anymore information since last year?

Captain VAN DYKE. No sir, our first testing production of 9L's will be after we get them off the production line. In May and June we will do that type of testing and be able to compare.

Mr. CROMWELL. What is your objective?

Captain VAN DYKE. Our final objective is 650 hours mean time between failures. Our initial contract objective for first run, first lot, is 350 hours.

9L PRODUCTION PLAN

Mr. CROMWELL. Will you describe your production plan as to how you intend to get competition into the annual buys and when?

Captain VAN DYKE. As far as the guidance sections, we expect to be fully competitive in 1979. In 1976 Raytheon produced the guidance

Digitized by Google

section; in 1977 both Raytheon and Ford will be producing them and in 1978 we will order a quantity from both Ford and Raytheon.

Mr. CROMWELL. When will you be full competitive?

Captain VAN DYKE. 1979.

SIDEWINDER FUZES

Mr. CROMWELL. The AIM–9L optical fuze costs $7,000 now, whereas the Army's Chaparral version of Sidewinder has a directional doppler fuze which I understand costs about $1,300 apiece. Why don't you use the Army DIDO fuze?

Captain VAN DYKE. There are considerable differences in the fuzes. The Navy fuze is a very precise edge detecting system that is necessary for the all aspect capability of the "L." It was designed in conjunction with the warhead which is a very narrowly focused blast so that it can put all its fragment right where the fuze goes off. Whereas the DIDO fuze is a radar fuze, it does not have as precise a burst control as the later fuze we have. It doesn't fire until it sees a negative doppler. In the air to air encounter where you have high speed, head on intercept, this fuze will be firing too late. At best, you would have to develop a new warhead which would focus the blast more in the aft direction.

EFFECT OF SMOKELESS PROPELLENT

Mr. CROMWELL. You are planning on a smokeless rocket. Does the smokeless rocket motor reduce the power or impulse available?

Captain VAN DYKE. We are planning right now on a low smoke which is not smokeless. No, it will not reduce the impulse. That is one of the requirements, to maintain the same total impulse.

Mr. CROMWELL. My information was that when you go to a smokeless rocket you get a 15-percent loss in impulse.

Captain VAN DYKE. If you go to an entirely smokeless I believe that is correct.

IRCM TECHNIQUES

Mr. CROMWELL. Regarding the infrared countermeasures, what are the various technical approaches to the flare problem and what is being done to evaluate them?

Captain VAN DYKE. [Deleted.]

Mr. CROMWELL. That is one approach. The Army has a different technical approach.

Captain VAN DYKE. Yes, sir. They have several [deleted].

Mr. CROMWELL. Is there any cooperative work or any effort being done to see which of these different approaches are better?

Captain VAN DYKE. Yes, sir. There was a D.D.R. & E. sponsored study headed up by the Air Force systems command that compared the several approaches, primarily looking at the postseeker to see if this was applicable across the systems.

Mr. CROMWELL. You are coordinating that effort?

Captain VAN DYKE. Yes, sir. All services were involved in this study.

Mr. CROMWELL. Thank you.

Senator GOLDWATER. Mr. Old.

Digitized by Google

FMS SALE

Mr. OLD. Captain Van Dyke, are there any anticipated foreign military sales figured in the estimated total missiles? When you are figuring what the program unit cost is do you have any anticipated military foreign sales in there?

Captain VAN DYKE. Yes, sir. The only ones figured into our costs are the 500 from Germany which seem pretty firm. That will be part of the 1977 buy. Other than that, there are no foreign military sales figured in our cost.

Mr. OLD. So when I look at the December 31, 1976, SAR and look at the quantity total of 4,440, 500 of those are anticipated for sales to FRG?

Captain VAN DYKE. No, sir, that is the Navy quantity. I am saying that our unit cost is based on buying an additional 500 for Germany.

9L MISSILE PERFORMANCE

Mr. OLD. Referring now to the performance of the AIM–9L and recalling your chart with the orange line, it says the demonstrated performance thus far for a beam shot [deleted]. Do you feel that your current estimate is [deleted] and the development estimate [deleted]. Are those still valid figures?

Captain VAN DYKE. Yes, sir. We don't always hit the exact parameter that is shown in the SAR which initial figures were based on. That is why that range is slightly different from the goal. Those figures are still good.

Mr. OLD. Which is more important, that you make the maximum shoot distance or the minimum shoot distance?

Captain VAN DYKE. As far as the beam shot, I think the minimum distance is the more important; certainly the hardest to set up and demonstrate.

Mr. OLD. You are currently [deleted] and you are working to get to [deleted]. Are you still confident you can make that?

Captain VAN DYKE. Yes, sir. There was an attempt to get shots near the minimum range, as you state, and they were not able to achieve that in the target setup but they did validate the simulation that was used that says we can get into that range.

Mr. OLD. Thank you very much.

Senator GOLDWATER. The Sparrow is next.

General SLAY. The Sparrow is next and Captain Don Wells, Navy, is the System Program Director.

SPARROW PROGRAM REVIEW

Captain WELLS. Good morning, Mr. Chairman. I will briefly cover the Joint AF/Navy Sparrow program with emphasis on the accomplishments of the past year and plans for the coming year.

Colonel Roger Engebritson the Air Force Deputy Program Manager, is with me this morning.

Digitized by Google

PRESENTATION OUTLINE

- SYSTEM DESCRIPTION
- PROCUREMENT STATUS
- PERFORMANCE STATUS
- IMPROVEMENT PROGRAMS
- FUNDING
- SUMMARY

Shown here is the Sparrow AIM–7F being carried on the Air Force F–15 air superiority fighter.

I will cover these general areas during the presentation.

DESCRIPTION/MISSION

THE SPARROW III IS A SEMI-ACTIVE RADAR INTERCEPT MISSILE USED INA NUMBER OF AIR-TO-AIR AND SHIP-TO-AIR WEAPON SYSTEMS OF U.S., ALLIED AND NATO COUNTRIES. IT PROVIDES ALL ASPECT ATTACK CAPABILITY IN ALL WEATHER CONDITIONS AGAINST A BROAD SPECTRUM OF AIRBORNE TARGETS.

The AIM–7F is the fourth operational model of the Sparrow missile. There have been 34,000 AIM–7 C, D, and E models previously produced.

The cutaway drawings show the major differences between the E and F. The F has a smaller solid state seeker which permits a larger more lethal warhead to be placed ahead of the flight control group and permits a larger rocket motor for extended range.

Digitized by Google

U.S. AIM-7 EMPLOYMENT

AIM-7F	NAVY	F4 F14 F18
	AIR FORCE	F15 F4E
AIM-7E	NAVY	F4 F14
	AIR FORCE	F4
RIM-7F	NAVY	IMPROVED POINT DEFENSE
RIM-7E	NAVY	IMPROVED POINT DEFENSE BASIC POINT DEFENSE

The Sparrow AIM–7 series missiles are used by both the Navy and Air Force. The AIM–7F is the only all weather missile compatible with the Air Force F–15. It is the primary radar guided medium range air to air missile capability for the Navy F–4, F–18 and F–14 aircraft and a modified version (RIM–7F) will be used in the Navy's improved point defense ship surface to air missile system. The AIM–7F replaces the AIM–7E currently used by both services.

FOREIGN AIM-7 EMPLOYMENT

AIM-7F	ISRAEL	
	(F15)	
	deleted	
	(F14)	
AIM-7E/ RIM-7E FAMILY	UNITED KINGDOM	BELGIUM
	IRAN	SPAIN
	ISRAEL	JAPAN
	ITALY	GREECE
	NORWAY	KOREA
	DENMARK	CANADA
	NETHERLANDS	SWEDEN

The Sparrow missile is also a primary weapon for more than 10 of our foreign allies. The AIM–7E has been available to these countries for some years and the first AIM–7F sale was recently approved. There is currently a letter of offer to [deleted] for the AIM–7F missile.

Digitized by Google

PROCUREMENT QUANTITIES

DSARC III/OCT 74

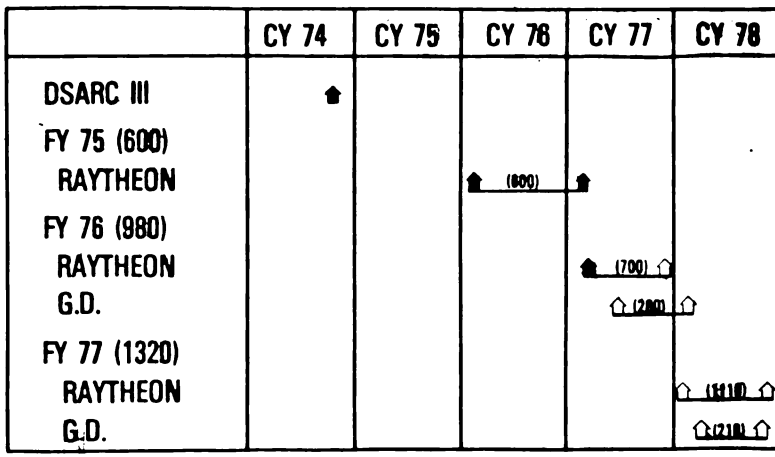
	NAVY	AIR FORCE	FMS
FY 75	300	300	-
FY 76	360	620	180
FY 77	440	880	(362)
TOTAL	1100	1800	180

Shown are the production quantities for the services that are being procured during the first 3 years of production. The FMS quantity in brackets is for [deleted].

Here is the production delivery schedule for both the prime and second source contractors.

PRODUCTION DELIVERIES

G&C UNITS



Digitized by Google

This is the Navy inventory versus assets protection through fiscal year 1982. As an example, in fiscal year 1977 the inventory objective is [deleted] missiles. We will have about [deleted] missiles, [deleted] AIM–7E and [deleted] AIM–7F at the end of the period. The E quantity contains both air to air and surface missiles. The clear area indicates inventory deficiency. In fiscal year 1980, the procurement of RIM–7F missiles for ships systems will start to reduce the inventory shortages.

FY-78 PROCUREMENT REQUEST

NAVY	425 MISSILES
AIR FORCE	1300 MISSILES

This is the same type of chart for Air Force assets except that AIM–7F and AIM–7E assets are shown in separate columns for each fiscal year. The E requirement is gradually reduced as the more capable F inventory is increased.

The fiscal year 1978 procurement request is for 1,725 missiles, 1,300 for the Air Force and 425 for the Navy.

TECHNICAL STATUS

CHARACTERISTIC	ESTIMATE	THRESHOLD	GOAL
GUIDANCE	deleted		
FUZING			
RELIABILITY:			
INITIAL ACCEPT	96%	95%	95%
MEAN FLIGHT HOURS BETWEEN FAILURE	400+	240	348

As a result of initial field testing of missiles, the missile performance and reliability estimates are as shown in the first column. This is based on about 60 firings and 2,500 hours of captive carry completed to date.

Digitized by Google

Senator GOLDWATER. Is your reliability based on launch or does it include the CEP?

Captain WELLS. The reliability, sir, is captive flight reliability. This is how long the missile survives on the aircraft. This is prior to launch type survivability.

FAILURE ANALYSIS

PROBLEM	CORRECTIVE ACTION	EFFECTIVITY
RADOME	NEW PRESCRIPTION	FEB 76
WING FLUTTER	WING TIP WEIGHT	JUN 76
F-15 SEPARATION	MODIFIED MISSILE A/P	SEP 77

During testing the past 2 years, problems with the radome and wing flutter were discovered. They were corrected as shown. During F-15 firings in the transonic range missile separation instability not seen before in F-15 testing occurred. The most cost effective method to correct this was a modification of the missile autopilot. This was done and tested and will be put into production this coming September.

PERFORMANCE HIGH LIGHTS

- HIGH ALTITUDE/HIGH MACH CAPABILITY DEMONSTRATED
- HIGH G ○ TARGET INTERCEPT
- LOOKDOWN LAUNCH Deleted
- OPENING VELOCITY ○ MILE TAIL CHASE
- SIMULTANEOUS LAUNCH FROM TWO SHIP FORMATION
- AVERAGE MISS DISTANCE deleted
- WARHEAD EFFECTIVENESS DEMONSTRATED
- SEASPARROW EFFECTIVENESS AGAINST SEASKIMMER DEMONSTRATED

Digitized by Google

Listed are some of the highlights of the more recent testing. Not only has the missile performed well in the air to air role, but the initial tests in the surface to air role were gratifying. In the latter role, capability against a [deleted] target was demonstrated by a direct hit on a target flying [deleted] feet above the water.

CONTINUING EVALUATION - FY 77

	AIR FORCE	NAVY
EXTENDED CAPTIVE	15 MSL/3000 HRS	15 MSL/3000 HRS
TEST FIRINGS	30 MISSILES	10 MISSILES (SEA SPARROW)

Shown are the major testing activities planned for the coming years. The missile will be used both in the air to air and surface to air roles. I might comment that the Navy is captive carry testing the missile 3,000 hours, starting last year, and we are about 2,500 hours into that.

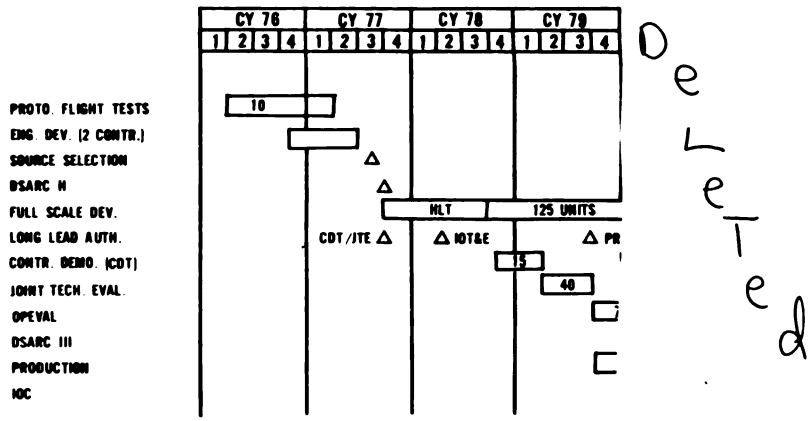
AIM-7F PROGRAM
MONOPULSE SEEKER

- EXISTING MISSILE SYSTEMS USING MONOPULSE TECHNOLOGY
  - PHOENIX
  - HAWK
  - STANDARD MISSILE
- IMPROVED PERFORMANCE
  - ECM ENVIRONMENT
  - LOOKDOWN HIGH CLUTTER
- PARALLEL PROTOTYPE PHASE
  - GENERAL DYNAMICS
  - RAYTHEON

Digitized by Google

The Air Force captive carry just started in February this year. The monopulse seeker program was started to overcome the inherent limitations of the AIM–7F missile in the lookdown in clutter and ECM. This is accomplished by use of the monopulse technique, inverse processing and the incorporation of an onboard digital computer.

IMPROVED MONOPULSE SEEKER SCHEDULE



The monopulse schedule is planned as shown. This will lead to an IOC of late 1980.

SUMMARY OF MONOPULSE PROTOTYPE EVALUATION

LABORATORY:

* SPECIFICATION COMPLIANCE
* ENVIRONMENTAL QUALIFICATION

SIMULATION:

OPEN/CLOSED LOOP
SINGLE AND MULTIPLE TARGETS
ECM TESTS

CAPTIVE CARRY:

* INTERFACE VERFICATION
* TWO/THREE PLANE CAPTIVE
* F-4J, F-14 AND F-15 AIRCRAFT
* SEASPARROW SYSTEM COMPATIBILITY

Shown is a brief summary of the current testing that the 10 development monopulse seekers are undergoing. When finished, there will have been over 11,000 simulated missile flights accomplished, about 60 hours of captive flight time will have been flown by each candidate seeker and flight tests conducted with each candidate seeker under two test conditions well beyond the capability of the AIM–7F. Those items marked by asterisks have been completed. The laboratory captive carry and simulation are still underway.

Digitized by Google

AIM-7F PROGRAM
MONOPULSE FIRING PARAMETERS

CLUTTER PARAMETER

- TARGET
- ASPECT ANGLE
- LAUNCH RANGE
- LOOKDOWN

deleted

ECM PARAMETER

- TARGET
- ASPECT ANGLE
- LAUNCH RANGE
- LOOKDOWN
- ECM

During the present technical evaluation two of each contractor seekers will be fired under the parameters shown. These firings will help verify the extensive simulation and captive carry tests being performed with the new seekers. Preliminary results in this evaluation are extremely encouraging. A complete assessment of monopulse will be made after conclusion of the evaluation late this month.

FY 78 AND 78 BUDGET

FEBRUARY 1977

($ MILLIONS)

	NAVY		AIR FORCE		PROJECT TOTAL	
	FY 78	FY 79	FY 78	FY 79	FY 78	FY 79
DEVELOPMENT	($18.9)	($11.4)	($2.0)	($4.1)	($18.9)	($15.5)
PROCUREMENT						
QUANTITY (MSLS)	(425)	(410)	(1300)	(1300)	(1725)	(1710)
MISSILE COST	$44.2	$43.0	$113.9	$111.8	$157.2	$154.8
FLEET/PECULIAR SUP	13.9	12.1	1.0	.8	14.9	12.7
INITIAL SPARES	1.8	1.5	0.2	0.2	2.0	1.7
PROCUREMENT TOTAL	$58.9	$56.6	$114.2	$112.6	$174.1	$169.2

NOTE: NAVY REQUEST CONTAINS ADD'L $6.5M FY 78 AND $12.1M FOR AIM-7E FY 78 SUPPORT, MODS & INITIAL SPARES.
DEVELOPMENT FUNDS INCLUDED IN PE63310F AMRAAM

This is our joint AF/Navy AIM–7F budget request for fiscal year 1978. The R. & D. funding requirements for the monopulse seeker development are shown in parentheses since they have been transferred

Digitized by Google

by DOD to the Air Force AMRAAM budget—(PE 63316F). Total R. & D. requirement for monopulse is $75 million of which $12 million has been expended to date in procuring the seekers and testing to date.

AIM-7F TOTAL PLANNED PROGRAM

	DEVELOPMENT		PROCUREMENT		TOTAL	
ORGANIZATION	QTY	FUNDS	QTY	FUNDS	QTY	FUNDS
NAVY	84	$99.8	9,720	$1,220.1	9,804	$1,319.9
AIR FORCE	50	16.2	9,100	857.9	9,150	874.1
TOTAL	134	$116.0	18,820	$2,078.0	18,954	$2,194.0

This summary shows the totals for the AIM–7F program for all years, Navy and Air Force, 18,900 missiles total planned.

This summary shows the totals for the AIM–7F program through all years.

SUMMARY

- ESTABLISHED PERFORMANCE THRESHOLDS/GOALS ARE BEING MET
- PRODUCTION DELIVERIES ON SCHEDULE/WITHIN COST
- AIR FORCE/NAVY TEST AND EVALUATION CONTINUING
- MONOPULSE SEEKER NEEDED FOR EARLY 1980's THREAT

To summarize the program, the missile is showing excellent performance in the field, the production program is well established and the 1st year production has been delivered. The follow-on program to improve performance in clutter and ECM is well underway and the results to date are extremely encouraging. This concludes the presentation. Lieutenant Colonel Engebretson and I are available for questions.

PRESS REPORTS ON SPARROW

Mr. CROMWELL. General Slay, the Sparrow missile had a lot of bad press last December and January. Articles in the New York Times said the missile was highly inefficient and alleged the Air Force hired Raytheon to write evaluation reports on whether the missile was working

Digitized by Google

and meeting its specifications. What was the situation with the Sparrow and with those press reports. Were they accurate?

General SLAY. No, they were not, Mr. Cromwell. They were considerably overstated. We did and do have problems with the Sparrow in ECM and in clutter. We are not going to completely fix those until we get into a different type seeker. That is nothing new. Also, it is something that is well advertised. AIM–7F's have a good capability against certain types of [deleted]. On [deleted]. have a good capability in the 7–F, and will not have, as long as you have a conical seeker. We will have a good ECM seeker in the monopulse.

In clutter and looking down we would like to be better, but it is not going to get much better. We can tweak it and make some improvement. The AIM–7F is perfectly usable in clutter as long as we restrict the look-down angle of our firings. We have known that. Notwithstanding those deficiencies, we are perfectly happy with the missile. It is the only all weather capability we have on the F–15. It is a tremendous asset. I see nothing in the AIMVAL tests to tell us otherwise. It is showing up well in the AIMVAL test as well as the AIM–9. So, as far as being a bad dog, it is not; it is a good missile. We want it. As a matter of fact, I am buying to the hilt right now on Sparrows and I would like to increase that amount. It is a matter of how much can be shoehorn in to our budget and what will the traffic bear as far as production capacity is concerned.

So that says what the Air Force thinks of the missile. As far as the article concerning hanky-panky in letting Raytheon do the analysis for us, basically the fact is that we let a contract with Raytheon, Aftec did, to do some data reduction analysis is absolutely correct. The inference is absolutely wrong. This is something that has been done by both the Navy and the Air Force for years ever since I have been connected with the test business. Raytheon was suggested by Point Mugu because Point Mugu had such a heavy workload that they could not do first-level data reduction on the Sparrow tests. This is always done to a certain degree for every weapon system. On everything we have ever bought, some data reduction is done by contractors. They don't analyze to say whether this is good, bad, or indifferent. They point out facts that are related to the data. You can't change the facts that are in the data. Raytheon of course has never made any effort to do that. As a matter of fact, we can point today and tell you that Raytheon first pointed these problems out to Point Mugu and they were confirmed by Point Mugu and AFTEC. They pointed out a fuze problem. Sure enough, when Point Mugu looked at it and Aftec looked at it, there was a fuze problem. The point I am making is that the fact is that the contract was let and the fact is that Raytheon did do first level analysis on data that they reduced. That much is absolutely correct. The inference that there was something nefarious or bad in that is absolutely wrong.

Mr. CROMWELL. Was Raytheon evaluating the results of the firings?

General SLAY. No, sir, they did not. That was done by AFTEC.

Mr. CROMWELL. Whenever you build a new airplane the contractor always does the data reduction?

General SLAY. That is correct.

Mr. CROMWELL. Is the same true in the missile field?

General SLAY. That is correct.

Digitized by Google

AIM–7F BEST CURRENT MISSILE

Mr. CROMWELL. Is there any better missile in the world today in this medium range radar-guided class than the 7F?

General SLAY. Nothing that even comes close to it.

Mr. CROMWELL. Anywhere in the world?

General SLAY. Not so far as I know. The closest thing is perhaps an R. & D. missile that the British have called Sky Flash.

TECHNICAL STATUS OF 7F

Mr. CROMWELL. You listed three problems, Captain Wells, which have been solved in the last couple of years. Are there any current outstanding problems that you are working on?

Captain WELLS. No major technical problems that we are working on at the present time. We are satisfied that what we have is working.

TEST RESULTS WITH MONOPULSE SPARROW

Mr. CROMWELL. What have been the test results in the monopulse program so far? Can you give us a summary of how many flight test firings you have had, how many successes and failures?

Captain WELLS. Yes, sir. We have launched four missiles to date. I would like to talk to the parameters. I would like to put the parameters back up. I would like to make the point that for initial firings of any seeker, particularly five development seekers, these are the first five ever built by either company, these parameters are rather significant. In the clutter shots we use T–38 drone target. We had to [deleted].

With the constraint of the China Lake range where we fired to get the required clutter ratio, clutter-to-target ratio we were looking for, we had [deleted] the target [deleted] and we had to fire [deleted] miles. The thing that does not show is that the targets is [deleted], above ground level. The launch aircraft was at [deleted] nautical miles but it also launched the missile at [deleted] feet above the ground. In other words, it was looking down about [deleted] feet over those [deleted] miles. So, the clutter was [deleted].

On the first launch the missile came off locked up on the target and was guiding successfully, a smooth flight. A tremendous amount of data was coming back on the TM. Fifteen seconds into [deleted] flight we had a realiability failure and the missile failed to guide after that. We recovered about [deleted] percent of the engineering data we desired on that flight.

Mr. CROMWELL. What was the failure there?

Captain WELLS. It was a component failure in one of the head tracking circuits.

Mr. CROMWELL. A transistor?

Captain WELLS. We have it narrowed down to the area in which it failed. It could have been a transistor, an operational amplifier, capacitor, perhaps even a cold solder joint. We know the area where it failed but it was a reliability failure.

Mr. CROMWELL. How can you tell that?

Captain WELLS. Obviously we didn't recover the missile. However, we saw the head tracking indications. We want to back into our simula-

Digitized by Google

tion and caused various failures. In one area we duplicated a failure and ran our TM. The TM tape we got out of that simulation run, you can lay over the actual flight tape and you can't even see the difference between the TM tapes. So, we feel very definitely we know where the failure was.

Mr. CROMWELL. That simulation facility out there allows you to do a precise analysis?

Captain WELLS. Yes, sir. As a matter of fact, I would like to make a comment on that simulation facility at Point Mugu. We are doing a tremendous amount of simulation on the seekers in that facility. All the captive flying that we have done, the missile actually functioning while carried on an airplane and all the flight tests we have done to date shows that the correlation between the actual flight test and the simulation are extremely close. We are extremely pleased with the correlation we have seen so far with that simulation. It is very, very accurate.

The second missile fired [deleted] parameter was a no test. Just before the missile was committed to launch the aircraft weapon system malfunctioned and both the [deleted] [deleted] and [deleted] in the aircraft dropped off the line. The missile left the aircraft with no target [deleted] or no [deleted] to its rear antenna. This obviated any chance for guidance although the [deleted] did come back on after the missile left the aircraft. We did pick up some useful data on the missile operation, although as far as the full missile test we have to say it was a missile no test. We expended a piece of hardware. On the first one, even though we had a failure, we got [deleted] percent of what we were looking for.

The only thing we didn't get was the actual intercept data. The last two missiles were fired under the [deleted] parameter. This again is an extremely difficult parameter for a first shot, particularly in the [deleted] world. The target was QF-86 at [deleted] feet, in both cases. The speed was [deleted] the aspect angle was [deleted], the launch range was [deleted] miles, the two launches took place at [deleted] miles. Again, the launching aircraft launched the missile from an altitude of [deleted] feet above sea level [deleted] to the target flying at [deleted] feet. In addition to the [deleted] we had a specified sea state of [deleted] of better, [deleted] knots of wind. In both cases [deleted] so we had a lot of [deleted] in the [deleted] of the target. The missiles were launched at [deleted] miles. The [deleted] involved two types [deleted] and [deleted] superimposed over that. The [deleted] is one of the hardest in which the missile has ever been fired. In both cases we had a direct hit. On the first one we destroyed the target. The second one hit the target, but we did recover that target. That was basically the result of our tests. We intend to go back and refire the one where we had to test with the aircraft failure. We intend to go back to try to repeat that to give that contractor's candidate a reasonable test.

MONOPULSE SUPERIOR TO 7F

Mr. CROMWELL. Could the current AIM-7F have made those shots?

Captain WELLS. No, sir. In the first case from those parameters [deleted] you would have to drive an AIM-7F into about [deleted]

Digitized by Google

before the seeker would be able to detect the target in the clutter that we were seeing. In the second case there is no way, even if the lauching aircraft was almost flying wing on the target, of the [deleted]. These two parameters are [deleted] of the 7F. [Deleted.] I think with the monopulse seeker as a semiactive missile, the Sparrow will be a superior semiactive missile for a long time to come.

STATUS OF MONOPULSE DEVELOPMENT

Mr. CROMWELL. General Slay and Admiral Mandeville, have you taken a position now whether monopulse should go into engineering development, or when will you take that position?

Admiral MANDEVILLE. First, we want to complete the advanced development testing. We have not taken a position at this point. We want to complete the advanced development and then come back again and get permission to move ahead with the program.

Mr. CROMWELL. When would you anticipate completing this testing?

Captain WELLS. If I may, we intend to finish up all the tests and evaluation by the end of March. The test consists of four areas, laboratory testing, flying, and so forth. In simulation, we are running each candidate missile between 3,500 and 4,000 simulation runs plus we are doing 7F as a baseline to compare it against. We are putting 180 simulated launches on the missile during the captive flight program where we actually had them in the air on airplanes. Of course, these two launch parameters here, in total data recovered on the program, the two shots account for a very, very small percentage although I think the results are rather significant. They do account for a very small percentage of the data that we are getting on these candidate seekers. We hope to have all the tests finished by the end of this month. We hope to be able to come in about the middle of April with preliminary data, conclusions and so forth.

Mr. CROMWELL. This committee has to make its judgments on whether or not to authorize your research and development requests for fiscal 1978 by the first part of May. I hope you can make that April date.

Captain WELLS. We are striving mightily to do that.

General SLAY. That is our goal. We understand your problem which is our problem, too. I might state from an Air Force viewpoint we are 85 percent certain that we want this modification right now even though in [deleted] we haven't had a good test as yet. Everything we see says that this is a good thing to do.

SKYFLASH VERSUS SPARROW MONOPULSE

Mr. CROMWELL. The British Skyflash is a monopulse variant of the 7E version of the Sparrow. Would you compare its characteristics with the 7F monopulse and also the program schedules and the status of the Skyflash? You can provide some material for the record that will show the differences in technical characteristics.

Captain WELLS. To some extent, Mr. Cromwell, we know the technical characteristics of the missile. We are, of course, in a support role

Digitized by Google

to the British at Point Mugu and we have not bought the missile, so we don't have the design or data package. Anything we say technically about the missile is what we have observed as a result of their flight tests out there and what we can deduce from the way the missile operates. We do not have definitive technical data on how they have implemented and mechanized their missile.

We have seen some fairly good flight results out there. They are moving ahead. They fired about 14 missiles. The only thing I will say to that is that the conditions under which they have fired them have not really tried the performance they say they have in the missiles. They have adopted a walk-before-run type of concept in developing the missile and testing it. I would think that to get to something like we just shot with our first two monopulse here, they are probably at least 10 or 15 missiles away from trying those sorts of parameters.

Mr. CROMWELL. I will withdraw the question then. Perhaps it wasn't proper. Although if there is anything you can give us in terms of a general comparison you might just do that for the record.

F–15 CANNOT USE SKYFLASH

Could the F–15 operate the Skyflash missile?

General SLAY. No, not without modification.

Mr. CROMWELL. Why is that?

General SLAY. It needs a [deleted]. The radar is a pulse doppler radar and just would not handle the E mechanism.

Mr. CROMWELL. How about the 7E airframe, is that also a problem?

General SLAY. The 7E airframe?

Mr. CROMWELL. Yes, in the Skyflash.

General SLAY. You mean the ejection forces? Yes, it is. You would have to have a harder back.

AIR FORCE/NAVY MISSILE COMMONALITY

Mr. CROMWELL. If we are going to retain commonality between the Air Force and the Navy in the Sparrow inventory would it be possible to do that with the Skyflash missile?

General SLAY. No.

Mr. CROMWELL. It does not appear that it would be.

General SLAY. No, I don't believe so. You can answer that better than I.

Captain WELLS. It would not appear so to us at this time. If the Air Force had to modify all their aircraft they might elect to go with the 7F. Our aircraft do have [deleted]. Obviously we would have a different family of missiles. At this point this time we don't really know enough about the Skyflash to know what the overall support requirements would be on the Skyflash.

Mr. CROMWELL. This committee has been urging the Navy and Air Force to retain commonality not only in their Sidewinder inventory but in their Sparrow inventory as well. So you can consider that when you look at the Skyflash.

88-370 O - 77 - 4

Digitized by Google

SPARROW R. & D. FUNDS

Mr. CROMWELL. The Sparrow R. & D. funds are contained in the Air Force program element this year. In previous years they were in the Navy program element. Why were they shifted and which service will run the monopulse R. & D. program?

General SLAY. I will try that one. That has about 9 months of history behind it, Mr. Cromwell. It has been through a cycle that I will try to walk you through. First of all, it was transferred to the Air Force with the direction that we submerge it in the new AMRAAM program. Both the Air Force and the Navy objected to that. Our objections carried. We suggested initially that this program be kept with the Navy intact. That was determined not to be in consonance with the congressional direction. However, we did convince the OSD staff that the Navy should be allowed to continue with the program direction for the monopulse as they had in the past. The fact that now the dollars are in the Air Force pot is correct. I do not think that the arrangements that we have currently with the Navy will interfere in the prosecution of this program by the Navy.

I would defer to Captain Wells for any additional information on that.

Captain WELLS. It would appear that the understanding of the arrangement we have between the Air Force and Navy is that we are running the program.

Mr. Cromwell, it will stay under Navy management and development and integration on the missiles.

Mr. CROMWELL. Is the Air Force going to send the money over to the Navy?

General SLAY. That is correct. My personal belief is that it would be a total disaster if we tried to jump in now in the middle of the Sparrow program and manage that when they have had 10 years of experience on Sparrow. It just would not make any sense. We were able to convince the D.D.R. & E. of that. The only thing we are doing is acting as the Navy's comptroller.

Mr. CROMWELL. Is it a joint program?

General SLAY. It always has been.

Mr. CROMWELL. Do you mean that the Congress told the services to put the money in the Air Force program element? I thought you said something about congressional direction.

General SLAY. That is a misnomer. Committee direction, not direction but committee desires.

Mr. CROMWELL. You can explain that for the record, if you will.

General SLAY. Yes sir.

[The information follows:]

The House Armed Services Committee report No. 94-967, dated March 26, 1976, recommended that the Director of Defense Research and Engineering (D.D.R. & E.) initiate the development of a new all-weather air-to-air missile to replace the Sparrow series missile. The committee desired that D.D.R. & E. insure a rapid development and an early operational date of this new missile. D.D.R. & E. responded to these recommendations in a letter to the House Armed Services Committee dated June 10, 1976, outlining a plan to form a joint Air Force and Navy project office which would be responsible for several advanced development air-

Digitized by Google

to-air missile programs. As a result, D.D.R. & E. consolidated funding for AMRAAM and AIM–7F monopulse into the AMRAAM program element. The Air Force and Navy presented a briefing to D.D.R. & E. in October 1976 which outlined our approach for separate advanced medium range air-to-air missile (AMRAAM) and AIM–7F advanced monopulse seeker development programs. In a December 1976 memorandum to D.D.R. & E., the Air Force recommended that the two programs be kept separate and that funds identified for the AIM–7F monopulse development program be redistributed to their former program elements. D.D.R. & E. has agreed to redistribute the monopulse funds as soon as the Navy receives direction to proceed with the AIM–7F monopulse program from OSD and Congress.

SUMMARY OF AIR-TO-AIR MISSILE STATUS

Mr. CROMWELL. The Secretary of Defense was required in last year's House-Senate conference report and authorization bill to certify that the Sparrow met Air Force and Navy mission needs and was combat effective. When the conferences added that requirement they knew full well the 7F did not meet all of its original performance goals. In fact, I think this committee covered those areas of deficiencies quite thoroughly last year in our hearing. I would like to get your summary statement, General Slay and also Admiral Mandeville, on what is your position on the overall status of our air-to-air missile programs this year? Should we go on with the 7F and with the monopulse?

General SLAY. Absolutely. From the Air Force viewpoint we have without any reticence whatsoever certified the AIM–7F as being combat effective. We did not in that certification intend under any circumstance to imply that the missile was without fault and that we didn't want to improve that missile and that we were forever and a day going to be satisfied with the performance that the 7F had. Beyond a shadow of a doubt, as I have stated for the record before, the 7F is a first-class addition to our inventory of weapons. We need it and must have it. We have no qualms at all about the certification that we made that it is a combat effective missile notwithstanding its limitations.

Admiral MANDEVILLE. The Navy supports that exactly. The missile is considered effective and there is no doubt we need it and require it, with the same reservation that we have known about the limitations and we feel they are a matched pair, if you will.

Mr. CROMWELL. Thank you.

PRINCIPLE OF MONOPULSE GUIDANCE

Senator GOLDWATER. Could you give us a brief, simple explanation of what monopulse acquisition really is?

Captain WELLS. You mean the acquisition of the hardware itself, or the performance?

Senator GOLDWATER. How does it work?

Captain WELLS. Basically in conical scan your beam is being rotated. In the conical scan the beam is rotated and it passes over the target several times. As the signal comes through, there is an amplitude change to the receiver. The fact is that the enemy can derive or scan the frequency and do certain things there to make the target appear

Digitized by Google

to be on the opposite side of the scan circle in a conical scan. The conical scan takes two or three scans to really get this information in the missile.

In the monopulse we call it that because it is basically simultaneously lobing, we derive all our information on the target from one pulse of energy reflected back from the target. In this we have basically four beams that go out there. We divide the antenna into four quadrants. We sum and difference in those quadrants to derive angular error from a single pulse of return energy, the angular error information on the target. So if anybody that is trying to use ECM that will work on a conical scan-type missile, this will completely negate his ability to indicate false positions on the target. In addition to the technique in deriving angular error, we have changed the way we take the signal in and process it. We use what we call an inverse process. In the present missile we take the whole world, target, ECM, and try to pull the target out inside the missile. In monopulse we squeeze down the gate with which we look at the target. We only look at the target and that area immediately around the target. This of course eliminates a tremendous amount of clutter, ECM, and extraneous signals from getting into the missile. We have a much cleaner signal to process. In addition to this, in these two particular candidate seekers we have incorporated onboard digital processors. This I think is a first of a family of very smart air missiles. We can bring logic into these things. Processing capability is increased. The algorithms, the logic we can build into these things are tremendously complex. We can make these things as smart as human beings in figuring out how to defeat an environment. Of course they are much faster.

Not only that, if something changes on the other side we have the flexibility to go into this computer and change it. So that we don't have a change all the hardware and redesign the missile to counter a new threat. We can reprogram this computer and meet the new threat without buying a whole lot of new hardware.

Senator GOLDWATER. Suppose in their ECM efforts they introduce an ECM target that will confuse your monopulse?

Captain WELLS. Then I think we would have to look at that. I think there would be a very good possibility in reprograming the computer so the missile could think around it. If not, it could be a combination of software and hardware. It certainly would not be the extensive redesign necessary today in analog type processing in air-to-air missiles.

Senator GOLDWATER. Where are you now on this experimentation?

Captain WELLS. We have fired four, two from each contractor. We are really in advance development. We have five seekers from each contractor. We have gone through this extensive ground testing and these two flight conditions. We will finish that up the end of this month. We hope with that data to come back to the committees through the Department of Defense and be allowed to continue with full scale development. If we are allowed to go and we can stay on schedule, I would anticipate an IOC in late 1980, we will actually have hardware

Digitized by Google

flowing. The other thing is that we are not redesigning the whole missile.

The only thing we are redesigning is the seeker warhead, radome, rocket motor, wings, and fins are all the ones being produced today for the 7F. As a matter of fact, on those missile flights we only bought the seekers, those missile flights are on 7F airframes.

General SLAY. I mentioned a moment ago that as long as we had the conical scan there were certain types of ECM that we would never be able to defeat. It is like this pen here (demonstrating), when it sweeps it sweeps like that. As long as the enemy can detect what that [deleted] is, it can either, through a [deleted] or through [deleted].

There is [deleted] in the monopulse. There is [deleted] for the enemy to determine. It makes it a very valuable tool against ECM plus all these other things that the Captain talked about, we think we have a winner. We are 85-percent sure.

Senator GOLDWATER. That is interesting. Thank you very much.

AMRAAM is next.

General SLAY. We have Col. Luke Boykin of Air Force Systems command, who is program director and Captain Burton Munger, who is the Navy counterpart, deputy program director.

AMRAAM PROGRAM REVIEW

Colonel BOYKIN. Good morning, gentlemen. I am Col. Luke Boykin, director of the AMRAAM Joint SPO. My Navy Deputy, Captain Burt Munger is also here. I will be briefing you on the beyond visual range Advance Medium Range Air to Air Missile or AMRRAM. It has also been called the follow-on replacement for the Sparrow missile.

Since this is the first presentation of the AMRAAM program to your committee, I will briefly discuss the requirement for the AMRAAM, the development approach, program and funding status and end with a short summary.

First, the requirement. A group of combat experienced pilots and maintenance personnel from the Air Force, Navy, and Marines completed a 13-month study in September 1976 which examined the air-to-air threat for the next 30 years. The study group was tasked by D.D.R. & E. under the senior Air Force and Navy Joint Requirements and Development Committee. The group carefully studied the world-wide threat and developed specific requirements to meet the threat. The group found that the threat included a wide variety of targets. Based on altitude and airspeed, the targets are found from slightly above the ground to [deleted] feet and vary in airspeed from subsonic to Mach [deleted].

Digitized by Google

AMRAAM
AIR TO AIR THREAT

NO SINGLE CLASS OF AIR TO AIR WEAPONS CAN COST EFFECTIVELY COUNTER

THE OPERATIONAL THREAT

A MIX OF WEAPONS IS REQUIRED

GUNS

SHORT RANGE MISSILES

} WITHIN VISUAL RANGE

MEDIUM RANGE TACTICAL

LONG RANGE INTERCEPT

} BEYOND VISUAL RANGE (WEATHER)

Unfortunately, no single class of weapons can cost effectively counter the broad operational threat. A mix of weapons is the most cost effective method.

If you can reach a position in clear weather to fire a gun, it is certainly an inexpensive way of killing the target. However, the wide variety of highly maneuverable targets make gun firing opportunities difficult.

The short range missile, such as a Sidewinder, with its maneuverability and range allows more opportunities to engage and defeat the enemy. This added capability does cost and the expense starts to increase.

The next step up the capability and expense ladder is the medium range all weather missile such as the Sparrow. The medium range missile can counter the short range target plus those beyond visual range and in weather. This added capability requires sophistication and complexity and cost. However, the opportunities to fire are increased significantly.

The final step in the ladder is the long range intercept missile such as the Phoenix. It is required to meet the extremes of the envelope and a smaller number are required to insure all targets can be countered.

The study committee determined that nearly all manned targets will be in the shaded area [deleted]. Over [deleted] percent of the threat is believed to be in this area. The threat for the AMRAAM was thus picked to be this area where [deleted] targets are found.

Digitized by Google

The shaded area outside the [deleted] feet and mach [deleted] indicates that, although the AMRAAM is optimized for the majority of targets, significant capability exceeding current Sparrow performance will be developed. The extremes of the threat environment were left to the follow-on intercept missile which will require more sophistication and complexity. This goal is a large number of capable missiles to meet the high concentration of targets, and a smaller number of intercept missiles to meet the extremes. This is certainly the most cost effective approach. The price of the AMRAAM missile will be reduced considerably and its performance optimized if the threat can be so defined and limited. Cost and capability are compromised when attempts are made to have a missile system do everything.

Then, the Joint Service Operational Requirement, or JSOR, for of the AMRAAM was formalized. Some of the details follow.

AMRAAM
THREAT FOR AMRAAM
(1985 TO D)

- HIGH CONCENTRATION OF MANNED AIRCRAFT FROM D
- AIRSPEEDS UP TO D
- MANEUVERING CAPABILITY TO D
- ALL WEATHER CONDITIONS
- WITHIN AND BEYOND VISUAL RANGE
- SOPHISTICATED ECM
- IMPROVED AIR TO AIR MISSILES

The AMRAAM threat for the period from 1985 to [deleted] is shown here. The missile will be optimized for the high concentration of manned aircraft from [deleted] feet. It will have considerable capability above these boundaries, but will be optimized with them.

Digitized by Google

The threat is expected at airspeeds up to mach [deleted] with maneuvering capability to [deleted].

The threat can be in all weather conditions, within and beyond visual range.

He will have sophisticated ECM and improved air to air missiles. Therefore, [deleted].

AMRAAM

AMRAAM PRIORITY REQUIREMENTS

- THREAT ENVIRONMENT
- EMPLOYMENT DOCTRINE
- MISSILE PERFORMANCE
- AIRCRAFT INTERFACE
- MAINTENANCE HANDLING

The JSOR gives great details on the priorities and goals for the AMRAAM the goals are divided into five categories.

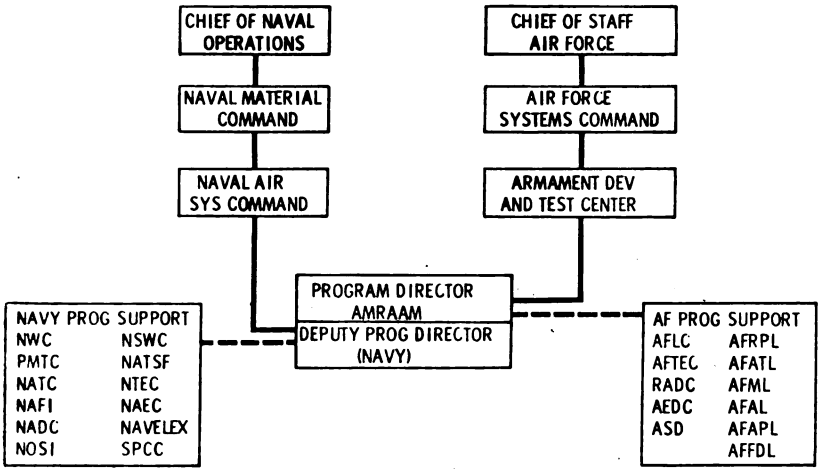
The categories of threat environment, employment doctrine, missile performance, aircraft interface, and maintenance handling list several desired and required goals. These goals are then placed on a summary matrix which allows the developer to trade performance goals by priority, to arrive at the best missile capability that we can technically achieve at an affordable cost.

A copy of the detailed matrix is provided with our charts. The JSOR goals attack all the shortcomings or limitations on current medium range missiles and add many capabilities which will provide significant air to air improvements. Design studies to date indicate all the JSOR required goals can be met.

Digitized by Google

AMRAAM

JOINT AF/NAVY AMRAAM PROGRAM ORGANIZATION



Now, let me show you how we are responding to the joint service operational goals. A joint system program office was formed on November 15, 1976 to develop the AMRAAM. This was in response to congressional and DOD direction. The JSPO is at the Armament Development and Test Center, Eglin Air Force Base, Fla. I am the program director and my deputy is Navy Capt. Burt Munger. This organizational chart shows who we report to and from where we derive our development support. We also have an assistant for operations matters who was a member of the JSOR study group and provides continuous coordination with Air Force and Navy operational organizations.

AMRAAM

AMRAAM PROGRAM APPROACH

- COMPETITIVE DESIGN DEFINITION (1 yr)
  - Three Contractors Selected From Open Competition
- COMPETITIVE PROTOTYPE DEVELOPMENT (3 yrs)
  - Two Contractors Selected From Open Competition
- ENGINEERING DEVELOPMENT (3 yrs)
  - One Contractor Selected From Two
- PILOT PRODUCTION (2 yrs)

Digitized by Google

This chart provides the present development approach, competitive design definition is underway. We have three selected contractors plus two independent contractors halfway through the design definition phase.

They are competing for two prototype contract awards which will be made this fall after design definition is complete.

One contractor will be selected for engineering development and pilot production.

Hopefully the engineering development and pilot production phases can be shortened considerably if we are successful in prototype and develop a missile near the production configuration.

AMRAAM
DESIGN DEFINITION
PRIME CONTRACTORS

- FORD AEROSPACE & COMMUNICATIONS CORPORATION
  (MARCONI SEEKER - XJ-521 DERIVATIVE)
- GENERAL DYNAMICS, INCORPORATED
- HUGHES AIRCRAFT COMPANY
- NORTHROP CORPORATION (MOTOROLA TRI-FAST SEEKER)
- RAYTHEON COMPANY

Digitized by Google

The prime contractors are: Aeronautic Ford and with Marconi of the United Kingdom as the radar seeker developer; General Dynamics; Hughes Aircraft Co.; Northrop, with Motorola as the seeker developer; and Raytheon.

This chart shows a guidance mode that is common with all of the contractors. However, the methods for achieving this capability are quite different and unique for each competitor.

The top illustration shows a missile launch for a fighter with a command inertial midcourse flight toward a target. When the missile [deleted].

Below, we see that in a dogfight encounter, the launch aircraft [deleted].

In addition to having [deleted].

AMRAAM
TECHNICAL ISSUES

- MISSILE GUIDANCE
  - MIDCOURSE
  - TERMINAL
  - HAND-OVER
  - AIRCRAFT AVIONICS DEPENDENCY
- END GAME
  - WARHEAD LETHALITY
    - SIZE, TYPE, FUZE
  - MISS DISTANCE
    - GLINT REDUCTION
- MULTIPLE AIRCRAFT COMPATIBILITY (F-14, F-15, F-16, F-18)
- LOW COST CONCEPT
  - UNIT PROCUREMENT COST
  - LIFE CYCLE COST

Digitized by Google

Techniques to integrate an inertial midcourse to a [deleted].

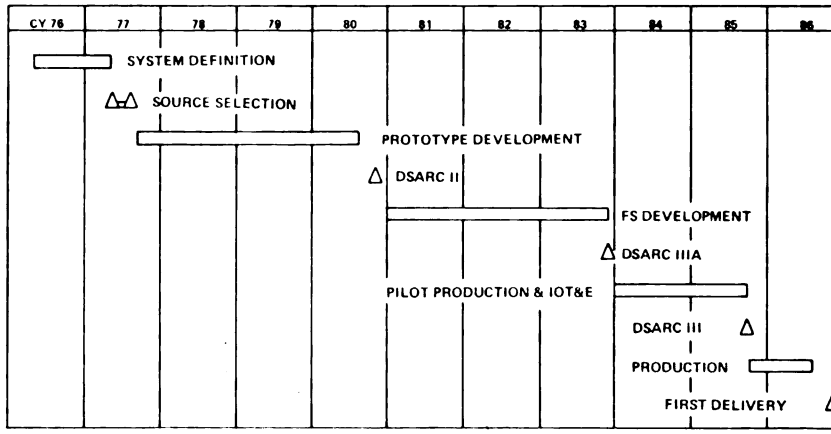
The end game encounter is most important as it will [deleted].

The technical task to electronically and physically integrate the missile to the F–14, F–15, F–16, and F–18 aircraft and fire control systems is a most significant technical problem.

All these factors, plus the goal of [deleted] will drive the cost. Unit cost may go up to insure low ownership costs.

Now looking at the current status of the Amraam program.

AMRAAM
SCHEDULE



We are now nearing the end of the design definition phase. A request for proposal will be forwarded in May prior to completing this phase. Source selection will then be accomplished leading to two negotiated contracts as soon as possible.

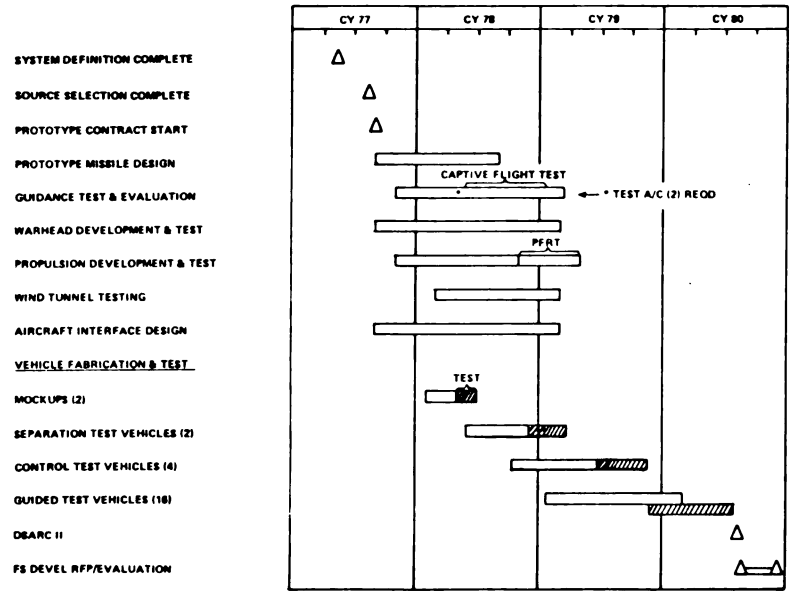
The prototype phase is very compact. We believe that a minimum of 36 months is necessary to develop and adequately test the Amraam goals with the stringent safety requirements for a weapon of this type.

The length of time remaining for full scale development and pilot production will be highly dependent on success during the prototype phase. The schedule shown here is logical and systematic. It includes the time necessary to adequately test the missile prior to DSARC review as well as the procurement times necessary for negotiated contracts. It can be shortened by innovative contracting and some long lead releases. We are now looking hard at ways to reduce schedule. We believe that up to 2 years may be saved by innovative methods and high success in the prototype phase.

Digitized by Google

AMRAAM

PROTOTYPE DEMONSTRATION SCHEDULE



Taking a closer look at the prototype demonstration schedule, we are projecting these activities over the next 3 years. You will note that a rocket motor for each candidate must be developed and safety certified prior to the first live missile firing. Each contractor will fabricate 22 missiles for the flight test program. The minimum number of launch parameters to obtain performance data toward a full scale development program will be exercised. We desire to develop and test a missile very near the final production configuration but allow consideration for technical improvements.

Turning to the current funding of the Amraam development program.

AMRAAM FUNDING

PROTOTYPE DEVELOPMENT

(FY 1978 PRESIDENTS BUDGET)

RDT&E (3600)

PE 63316

PRIOR YEAR	FY 77	FY 78	FY 79	TO COMP	TOTAL
$0M	$5.0M	$23.6M	$36.7M	$16.3M	$81.6M

The sum of $81.6 million of R.D.T. & E. is required for completion of the Amraam prototype development effort as soon as the design concept phase and cost trades are completed.

Digitized by Google

AMRAAM FUNDING ($ IN MIL)
PROTOTYPE DEVELOPMENT PE 63316

FY 78 RDT&E BUDGET REQUEST

● AMRAAM	
● DESIGN	11.9
● HARDWARE	3.8
● SYSTEMS ENGINEERING/PROGRAM MGT	3.9
● TOOLING & TEST EQUIPMENT	.2
● TEST & EVALUATION	1.7
● DATA	.4
● MANAGEMENT & SUPPORT	1.7
	23.6

For fiscal year 1978, the American budget request or R.D.T. & E. funds consists of $23.6 million which will be utilized as shown in this chart.

SUMMARY

- PROBLEMS WITH CURRENT WEAPON SYSTEMS KNOWN
- THREAT DEFINED
- JSOR CONSIDERS BROAD PROBLEM AND SPECIFIC THREAT FOR AMRAAM
- DEVELOPMENT APPROACH SOUND, LOGICAL, SYSTEMATIC
- SUCCESS DEPENDS ON MANAGEMENT / TECHNICAL SOLUTIONS / SUPPORT

Digitized by Google

In summary, limitations on current medium range air-to-air missiles are known.

An outstanding joint study of the threat has led to a specific threat for the follow-on to Sparrow, or the Amraam. The joint requirement meets Air Force and Navy needs.

We have developed a sound, logical, systematic development program which would lead to a missile which attacks all the problems with current mid range missiles and will provide significant capability improvements.

Success of the program will depend on management within Government and industry, technical solutions by the contractors, and support from Congress, the DOD, and the services.

MISSILE CHARACTERISTICS

Mr. CROMWELL. That was a very find rundown on the program, but it was a little bit general as to the specific technical requirements that this new missile is going to have to meet. Can you give us some more specifics on the weight, the size, the range and maneuvering performance, and warhead, things of that sort you are looking toward?

Colonel BOYKIN. Yes, sir. I can do it two ways, give you a few viewgraphs or provide it for the record.

Mr. CROMWELL. Why don't you go ahead with the viewgraphs?

Colonel BOYKIN. As I showed you previously, there are five categories of priorities. On these charts at the top is the highest priority. All of these things are needed by the operators but they did prioritize them for us. This really helps to develop them when we do our tradeoffs. Of course, all weather capability, any weather conditions you fly in.

Look down capability, be able to intercept targets down to [deleted] foot altitude over land and water.

Great ECCM capability. These are monopulse techniques we are talking about, at least as good as the monopulse.

[Deleted.]

Higher term natural G capability. We want to be able to intercept a [deleted] target when he starts his maneuvers at [deleted.] This is from the maximum range situation. [Deleted].

Under "employment doctrine", this one here is the significant thing I showed in the chart. [Deleted.] This is a very important tactic.

Minimize launch to eject time. [Deleted] from trigger squeeze to first missile motion. You want an [deleted].

Minimize crew tasking.

Simplified cockpit procedures, at most a three step launch sequence. We have to make this missile easy to launch.

Capabiilty of missile fire. This is [deleted].

Also the capability for [deleted.] This is to go along with the 14 capability.

Navy requirement here, missile checks in [deleted], be able to check out the missile on a carrier [deleted].

Maximum Pk. If you ever get in a position to fire be sure you get it.

Maximum reliability. That is self-explanatory.

All aspect launch and track. There are present limitations [deleted] with a radar missile. We want to eliminate that problem.

Digitized by Google

Maximize average missile speed. Let me explain this. If I fire on an airplane under conditions shown here, about [deleted] miles away, by the time the missile hits the target I will still have [deleted] miles. It is called a [deleted].

By the way, I might say this. The AIMVAL–ACEVAL program is showing this is a very important factor [deleted].

A minimum launch range. Minimum range performance at least equal to the 7F.

Target discrimination resolution. If you are going after the [deleted].

Maximum launch range. At least [deleted] nautical miles. This was condition of launch. [Deleted] feet looking down at the [deleted] foot target.

Now, on the aircraft interface, which is the very key here, when we have multiaircraft compatible with all four of those airplanes.

We want to minimize the missile weight and drag. Desired is under 200 pounds, required under 350.

Since you asked that specific question, the design definitions are now in the [deleted] category to meet all these other requirements. It looks like you can do that.

Missile preparation. [Deleted] preparation time with a [deleted] validity. You could smash a button and the thing is ready to go for [deleted].

Minimize missile aircraft interface mode. We want to be able to hang them on four airplanes, so there might be some launcher adaptor requirement to meet all those airplanes. As part of our program we will develop whatever is required in the launcher area, either rail or ejector launches.

Missile test status. We want a built-in test capability.

Carriage and launch. To be able to carry this thing through the flight envelope of the four airplanes.

Missile color. [Deleted] color you can see pretty well from another airplane. If we can come up with a nonreflective finish it might make the missile harder to see visually.

Mr. CROMWELL. That looks like the easiest problem to solve.

Colonel BOYKIN. It turns out it is not. If you get [deleted].

All up round. Shipped as complete assembly less control surfaces. Efficient flexible configuration changes where you can up load and down load quickly.

Positive ground safety with routine aircraft maintenance without missile down load.

We want to minimize ownership costs as I said before, an all up no maintenance type missile.

Environmental protection, 10-year shelf life and maintenance concept of no organizational maintenance on the flight line. If it is broken you send it back to the depot.

That completes those five categories of requirements for the JSOR. I know you can't read this thing from there—but what they did for us is show all of those five in a matrix and said the most important thing is all weather and maximum Pk. This allows the developer to come out with a missile that will do the best job and something that we can afford.

Does that answer your question, sir?

Digitized by Google

MISSILE WARHEAD SIZE

Mr. CROMWELL. Thank you, yes, it does. What is the warhead size for the missile and is that dependent on the missile weight?

Colonel BOYKIN. The ability of the missile to guide in close to the target certainly is the first. If you can get one that either hits the target or gets in close, then I can reduce the size of the warhead. The trade we are doing now, we think that guidance techniques we have can get you very close. So you are not going to need a very large warhead. But the size of that warhead is determined by how close you can get. It looks like on our design studies so far that we can use a conventional proximity fuzing scheme, we don't have to go to a super sophisticated fuze for directed blast type warheads. They will be in a cylindrical type configuration directional. They don't go out 360 degrees. But we do not require a supersophisticated fuze, we can have a fairly conventional proximity fuze with a warhead in the 30 to 50 pound category. That is the range that we are in right now.

Mr. CROMWELL. Is the warhead size determined in part by the weight of the missile? Is there a relationship?

Colonel BOYKIN. I think we start at the other end, based on how close you can get with the size of the warhead, and then the missile grows from that, from the payload.

Mr. CROMWELL. What is the Sparrow 7F warhead size?

Colonel BOYKIN. I believe about 90 pounds.

General SLAY. Eighty-six to be exact.

Mr. CROMWELL. Would you say the lethality of the new missile will be less than that of the Sparrow?

Colonel BOYKIN. No, sir.

Mr. CROMWELL. Why not?

Colonel BOYKIN. If you can get in closer you don't need a 90-pound warhead—or the 86-pound warhead. That is a very effective warhead. We got kills out at [deleted] feet with the 7F warhead. If you can get real close you don't need all that warhead. That is the key to the Sparrow missile. We are going to keep the range. We are going to have the performance envelope that the 7F has. It will be slightly larger than a missile half the size.

EFFECT OF MISSILE SIZE ON AIRCRAFT PERFORMANCE

Mr. CROMWELL. What is the difference in airplane performance, in terms of range and maneuverability, when carrying the new missile as opposed to carrying the 7F Sparrow on the F–14, F–15, F–16, and F–18?

Colonel BOYKIN. On the larger airplanes it certainly is not as significant as it is on the smaller ones but that difference of half the weight on an F–16 or an F–18, a smaller very maneuverable airplane does not make quite a difference. I don't have good answers as to what percentage you lose. Those things will be in part of our design that we are doing now.

General SLAY. If you can assume a Sparrow on an F–16, to start with, an AIM–7F, and you go to an AMRAAM from that Sparrow, I doubt if you would increase your wing loading and your instant G capability more than 3 or 3½ percent.

88-374 O - 77 - 5

Digitized by Google

Mr. CROMWELL. It would a 3- to 3½-percent difference on the F–16 and perhaps 1 percent or so on the bigger airplane?

General SLAY. It will be less than that. Particularly on the F–15 they are semisubmerged anyhow. The F–14 is a big airplane. So, it would be less. I guess the point I am making is that if you assume the same pylon drag as the current Sparrow and just hang the lighter weight missile with its smaller cross-section underneath it, you are not going to gain all that much in drag count or in ability to pull G's instantaneously. Where you would have to gain is cutting down the frontal area of the pylon by designing a smaller pylon or doing something to snuggle the missile up against the fuselage so that you can eliminate the drag count. The pylon is the biggy as far as drag is concerned.

BASIS FOR MISSILE WEIGHT LIMITATION

Mr. CROMWELL. How was a 350-pound maximum weight limit arrived at? Was the effect on the airplane performance considered or evaluated when you put that restriction on the top weight?

Colonel BOYKIN. I am sure it was, sir, but I am not in the requirements business.

General SLAY. I think one of the things we wanted to do is to make it more easily handled on loading.

Captain RYAN. During the course of the year, of course, we had some contractor help to do this study. We felt 350 pounds was a good starting point at the high end and at the lower end we stopped at 200 pounds. It was a consensus of opinion based on contractor input that we could fall within those two ranges.

Mr. CROMWELL. You could fulfill the general goals with a missile within that general weight range.

Captain RYAN. Yes, sir.

Mr. CROMWELL. Then the airplane performance was not the driving factor, I guess.

Captain RYAN. No sir.

AMRAAM COST ESTIMATES

Mr. CROMWELL. How do the production costs of the monopulse Sparrow compare with the AMRAAM? Have you looked at that in detail yet?

Colonel BOYKIN. The production cost?

Mr. CROMWELL. Yes.

Colonel BOYKIN. No, sir. We are talking about a missile at half the cost of the Sparrow in today's dollars. That is the goal we are looking at, half the size, half the cost.

Mr. CROMWELL. You are talking about it. Have you done the detailed costing yet?

Colonel BOYKIN. No, sir. As part of a design definition study we will have good cost dollars in a couple of months. We do have our parametric studies which indicate what I have said, it will cost around $40,000 to $50,000. But I really feel that we will have good estimates when we receive these proposals in June.

Digitized by Google

TECHNICAL RISK IN AMRAAM

Mr. CROMWELL. How much technical risk is there to the new guidance systems being considered in these missiles?

Colonel BOYKIN. I would say the technical problems are in the mid, at least mid to high risk.

Mr. CROMWELL. High risk?

Colonel BOYKIN. Yes.

POSSIBLE RAMJET PROPULSION

Mr. CROMWELL. Has ramjet propulsion been considered with the new missiles?

Colonel BOYKIN. Yes, sir. We have looked at the ramjet and we will be looking at it. But our schedule will not allow some of the newer techniques. Ramjet is something we can always bring in later. It appears to me that on the smaller missile it might be more logical to stay with the conventional rocket motor and for the intercept missile, longer range missile, take a hard look at the ramjet.

Mr. CROMWELL. What performance will be gained by changing from a rocket motor to ramjet?

Colonel BOYKIN. It takes less weight to get that range. I think it is basically a weight consideration and then it is still powered when it reaches the target the end capability is certainly greater when you are in power flight when you intercept a target.

Mr. CROMWELL. McDonnell Douglas did a study——

General SLAY. Let me interrupt here for a minute. You could not have a missile that would be anything without having a hybrid. You have to have a hybrid rocket-ramjet in order to get the initial impulse to get the ramjet into its environment, something like we have on our ASALM. There is technology effort underway for that both in the Navy and Air Force. We have demonstrations already and I think you are going to hear about them. The pure ramjet I don't think would be too much in the cards because it is ineffective at the subsonic launch speeds. It would take awhile for the thing to boost itself up. You have to have some sort of booster.

STUDY OF RAMJET MISSILE

Mr. CROMWELL. I was going to refer to the study done by McDonnell Douglas which showed that you could take the kind of guidance that is being talked about here for the AMRAAM missile, use ramjet propulsion, have a fairly large warhead, and you could have an 8-inch missile which weighed about 500 pounds, the same weight as the current Sparrow, yet it would have the performance envelope of the Phoenix. So this missile would indicate the advantage of ramjet propulsion.

General SLAY. There is no question you can certainly get long range out of a ramjet, much longer than a rocket, for an equal weight.

Mr. CROMWELL. Also, as Colonel Boykin said, you also can get tremendous maneuverability at the medium ranges of [deleted] miles against a maneuvering target. Was that study evaluated? Do you know anything about it?

Digitized by Google

General SLAY. I have not seen the study.

Mr. CROMWELL. The Navy paid for it.

General SLAY. I have not seen it. We are deeply involved in a program called Advanced Strategic Air Launch Missile which is follow-on to SRAM and ALCOM. That is a ram rocket which uses the rocket to boost it up to speed and it cruises [deleted]. It goes [deleted] at high altitude. It has tremendous maneuverability anywhere during the flight regime. ASALM is a big missile. It is 25 inches in diameter versus 6 to 8 you are talking about.

Mr. CROMWELL. Will you provide material for the record on that study?

SIRCS MISSILE REQUIREMENTS

The Navy shipboard SIRCS program is producing a new 8-inch missile with [deleted] IOC. That missile is Sparrow sized and the same IOC you are talking about for the AMRAAM. Have you investigated to see if both the air-to-air and surface-to-air requirements can be met with a single missile development, since the present Sparrow is used for both air-to-air and surface-to-air roles?

Admiral MANDEVILLE. We are looking into this. The surface-to-air requirements were fed into the JSOR that Colonel Boykin was talking about. We have tried to overlay these on the present requirements. They don't look too terribly compatible right now. This is being worked on actively in the Navy to try to see if it makes sense economically. I am not sure where our requirements between sea and air fit in this, but we have had a lot of dialog on this. It will soon be worked out.

Mr. CROMWELL. If one missile could do both jobs it could save development costs and also reduce production cost.

Colonel BOYKIN. Yes, sir.

Mr. CROMWELL. But you are still looking at this question?

Colonel BOYKIN. Yes. Right now we are kind of disconnected at the moment. The requirement we are getting from the ship side is fairly excessive. We have a dialog at the moment to try to see if we can end up with the same missile.

ADVANCED INTERCEPT MISSILE REQUIREMENTS

Mr. CROMWELL. What is the status of the advance intercept missile SOR. Are there any funded studies being done that are similar to what you are doing on the Amraam?

Admiral MANDEVILLE. The JSOR spoke to it. In our planning we were trying to move into this direction. We did consciously decide to step in behind Amraam and let them make a phased program out of it rather than try to do it concurrently.

Mr. CROMWELL. If there is any validity to what McDonnell Douglas is saying, it would appear that both the Amraam and Intercept requirements could be met by the same missile if the advantage of the ramjet propulsion is that good. It would appear that it would be worthwhile to take a look at this before going off with this 350-pound missile.

Digitized by Google

Admiral MANDEVILLE. I have Justin Malloy here who can speak to the validity of that study.

Mr. MALLOY. I am scheduled at the end of this session today to give you a 4- to 5-minute rundown on the McDonnell Douglas study. The McDonnell Douglas study we consider valid. We have asked for a similar design study by McDonnell Douglas also, a design study doing something very similar to the Navy. Things have been closely coordinated. I think among the technology people the study is considered valid. I am prepared to talk to that during the briefing later this morning.

PREPARED STATEMENT OF JUSTIN MALLOY

I am Justin Malloy, Director of the Advanced Weapons Systems Division in the Naval Air Systems Command.

My subject today is the results of our advanced system studies on Ramjet air-to-air missiles.

In exploratory development we do periodic system studies on the performance of current systems against projected threats. Our studies on the Sparrow showed that although the Sparrow was designed as a head-on intercept weapon, most actual Southeast Asia encounters with the AIM–7E ended in a tail chase. This occurred because the rules of engagement required a positive visual identification. The F–4 was required to fly by, identify, do a 180° turn and attack. The velocity lost in the turn frequently presented the Sparrow with an opening target. No current U.S. air-to-air weapon is designed to close the gap against a rapidly opening target. The AIM–7F development initiated in the mid 1960's increased the performance of the missile by utilizing solid state electronics and increasing the size of the rocket motor. This figure shows the performance of the AIM–7F against a cospeed target [deleted].

The launch range against a maneuvering target is represented by the smaller envelope and the tail chase range, even in a cospeed situation is relatively small. This indicates that the system is propulsion limited. An efficient propulsion system that would make launch range equal to guidance range in all target aspects should provide an extremely versatile weapon with substantial growth potential.

The solid rocket motor is on a relative plateau in terms of efficiency. This plot shows the relative performance of air-breathing engines versus the solid rocket in terms of specific impulse—i.e., pounds of thrust per pound of fuel burned per second. [Deleted.]

Ramjets are not new. They have been in development since the mid-1930's. Early experiments with simple "stovepipe" ramjets led to the development of three ramjet missile systems by the United States. Talos was an inline ramjet with a jettisonable solid propellant booster (ramjet operation is not practical [deleted]. The Bomarc and Red Headed Roadrunner were podded ramjets with a separate solid rocket booster. All three of these systems have been retired from service—primarily because they were too large. However, their unique performance in terms of high speed and efficiency has led to extensive employment as targets.

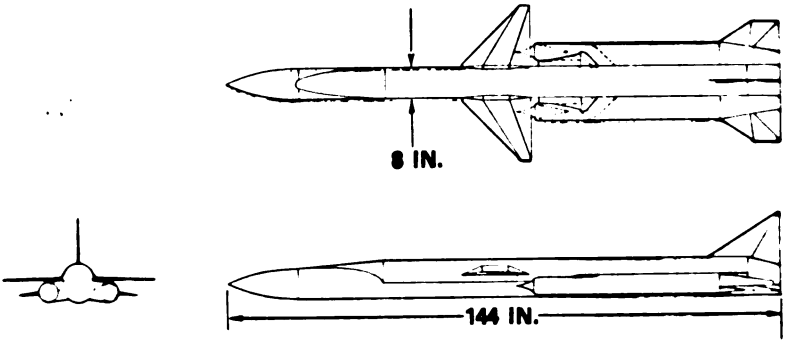
Research on the significantly smaller integral rocket ramjet started in the Navy in the late 1950's. The integral rocket ramjet concept packages the booster rocket in the ramjet combustion chamber. The rocket is expended within a few seconds in accelerating the missile [deleted]. At that time the rocket nozzle is expelled, the air inlet port covers are ingested, disintegrate and the fragments are expelled. Ramjet fuel [deleted] is ignited and the missile cruises at high velocity and with high efficiency.

An effective comparison of the physical size of Talos with a modern air launched integral rocket ramjet is shown here.

The ramjet vehicle shown is the air-launched low-volume Ramjet, an air-to-surface configuration advanced development model being developed by Vought Systems Division under Naval Air Systems Command sponsorship. Five of these vehicles have been flown to date in various flight profiles with complete success.

Digitized by Google

ADVANCED BVR INTERCEPT MISSILE (U)



LAUNCH WEIGHT = 507 LB
PROPELLANT WEIGHT = 133 LB
RAMJET FUEL WEIGHT = 45 LB
EMPTY WEIGHT = 316 LB

ALTITUDE, FT	SEA LEVEL	30K	30K
RANGE, NMI MACH NO. MANEUVER g's	DELETED		

Our study of ramjet application to a Sparrow-sized missile was conducted by McDonnell Douglas, St. Louis, under the technical direction of the Naval Weapons Center. Constraints were Sparrow size and weight. This is the configuration which has resulted from the study. A design which is at Sparrow weight and size, physically interchangeable with Sparrow on the F-14, F-15, F-18 and F-4 aircraft. The ranges for target at sea level and 30,000 feet are for co-altitude launches, the range for the target at 90,000 feet was for a launch at 30,000 feet. The maneuver g's are significantly higher than Sparrow (Sparrow can pull [deleted] g's momentarily during end of the boost phase of operation while the missile is still accelerating). The g's shown are sustained g's and the airframe is a modern bank to turn airframe which will provide high angles of attack and keep the ramjet sustained with adequate intake air flow.

COMPARISON OF MISSILE DESIGN PARAMETERS (U)

		LAUNCH WEIGHT LB	WARHEAD WEIGHT LB	TOTAL IMPULSE LB-SEC
SPARROW	8 IN.	510	90	DELETED
AIAAM	8 IN.	508	D	
PHOENIX	15 IN.	985	135	

Digitized by Google

A comparison of this design with Sparrow and Phoenix is shown here. Note that it has nearly three times the total propulsion impulse of energy of the AIM–7F in the same size and weight. (This design is probably near the lower limit of physical size for practical integral rocket ramjet designs. The ramjet requires a fuel tank and a fuel management system—hence the full potential of efficiency improvement of the ramjet over the solid rocket on a weight and volume basis cannot be realized). However, total energy approaches that of the Phoenix and the smaller size and weight means considerably less drag.

The efficiency of the integral rocket ramjet offers high acceleration, high sustained velocity, long flight duration and hence the energy to sustain high "g" maneuvers throughout the flight. (For missiles with solid rocket propulsion target misses near the maximum flight ranges are as much or more dependent on maneuver energy than guidance accuracy). The curves shown for AIM–7F and AIM–54A Phoenix indicates the limited potential of the solid rocket. In every solid rocket missile application today we are weight, volume and efficiency limited. We have to compromise in our apportioment of the total energy (thrust profile) in an attempt to optimize for a wide variety of flight conditions.

The next figure compares the launch acceptability regions of this advanced ramjet missile against Sparrow and Phoenix at 30,000 feet with a target speed of [deleted] and a launch speed of [deleted]. The top half of the curve shows performance of all three against a nonmaneuvering target and the bottom shows all three against a [deleted] maneuvering target. The boundary conditions for the missiles are as indicated. (I must caution against absolute judgments made on Sparrow or Phoenix performance on the basis of any single plot such as these because the envelopes shown are for this altitude, target and launch speeds, and target maneuvers only. There are not necessarily the optimum launch conditions for any of these. A family of such plots for all altitude, target speeds, launch speeds, and maneuvers is necessary. However, in all cases, the increased efficiency and sustained speed of the ramjets show significantly better performance.)

This plot compares the performance of the three designs in a vertical envelope in head-on attack against a target speed shown on the far right. The launch aircraft, an F–14 is shown at 30,000 feet and a speed of [deleted]. The conditions shown as outer boundaries for AIM–7F and Phoenix are a velocity of [deleted]—the lowest velocity at which those missiles can pull a [deleted] maneuver. (Again the same caution about absolute configurations of Phoenix and Sparrow capabilities on basis of this single altitude and launch speed plot needs to be emphasized).

Carry drag of integral rocket ramjets on aircraft which has been a major concern for our fighter pilots does not appear to be a significant problem. The design of the conceptual 500 pound ramjet missile has been verified in wind tunnel tests. (The F–4 and F–14 semisubmerged Sparrow installations generally exhibit lower drag with missiles installed than with the wells empty).

The study has indicated several significant things: (1) that kinematic performance equivalent to Phoenix can be attained in a Sparrow sized missile compatible with F–14, F–15, and F–18 aircraft. The reduced carry weight for the F–14 is shown in Figure 12, (2) Carry problem, (3) a missile employing IRR propulsion is necessary to counter evolving threats and (4) extends the superiority of current aircraft, i.e., F–14, F–15, and F–18.

Current Navy plans call for initiation of Advanced Development of the propulsion and airframe system in FY–1979.

LACK OF OVERALL PROGRAM COORDINATION

Mr. CROMWELL. I will make a comment now about the SIRCS program and apply it somewhat generally to this new AMRAAM program, and then I will bring this up again with the Navy ship people who will be up before us next Monday.

The SIRCS program started out under this new OMB circular 109 to take a fresh look at the requirements. They have funded studies with contractors who have come in and reportedly are saying that they have to develop a brandnew radar and a brandnew missile, the size of which I have already alluded to, to solve the ship defense problem.

Digitized by Google

It raises the question, apparently that there is not too much coordination under OMB 109 procedures, between the air-to-air world and the sea world. I am wondering if maybe OMB 109 is not getting us away from the ability to take a general overall look at DOD requirements. We should look at what kind of missiles in this size class of 300 to 500 pounds and about 7 or 8 inches in diameter, should be developed for this 1986, 1987, 1988 IOC. I welcome your comments. But it appears that this AMRAAM program has not been coordinated against those other programs to see if it would be possible to develop just one missile to solve these different needs.

Colonel BOYKIN. Sir, we have had very close contact with all the people involved here. I think that is one point I tried to make in my briefing here. When we try to make the missile do everything we are really going up in complexity and sophistication and cost. I think that the technology though that we gain in the AMRAAM certainly can be sized to meet these other requirements. When you get into the basic physics, the size of the antenna, I think the long-range intercept problem and Sea Sparrow problem are different. I think you can put a different antenna. Certainly you can gain from the technology. I believe trying to make a missile, itself, that meets all those roles is another question so far as I am concerned. I have looked at those other requirements. I have looked at what my JSOR says they want this missile to do. I believe that we have to go along together. I would be a little concerned about trying to make the AMRAAM take those roles.

Mr. CROMWELL. I can understand your concern. You spent about $2 million, I believe, so far having contractors do different preliminary design studies. I gather from what you said here that they did not do the same kind of low level of effort study to see if it could or could not meet the other different roles. Is that correct?

Colonel BOYKIN. Not this particular missile.

Mr. CROMWELL. Thank you.

REQUIREMENTS OF OMB CIRCULAR 109

Mr. OLD. Following up on Mr. Cromwell's question, is it your judgment that this program does meet the provisions of OMB circular 109?

Admiral MANDEVILLE. It does. Two contractors going into prototype. Narrow it down on full scale. It is classic 109.

Mr. OLD. That has generally been the way the services have done a lot of their prototype programs. I thought 109 was a little more in depth in that it asked or felt that the services or agencies should examine to see if there are other ways that the mission required could, in fact, be done. You started off with the assumption that this missile is what is required. Maybe there is a possibility that the improved Sparrow could in fact do this. Maybe it could be grown to this potential. That to me would be a full examination or meeting fully what A-109 calls for. If you read the GAO report on three of the systems that were referred to as having met 109, Navy SIRCS, Air Force NAVSTAR and Army—I am not sure what the Army program was—Pershing II, they are critical in this particular area. I am not totally convinced that you get a passing mark in this regard. You could add

Digitized by Google

some more if you wish but I am not quite sure how they are going to come to grips or the Department is going to come to grips with this new circular. We are kind of getting familiar with it. It really is not effective until the fiscal year 1979 budget. I think that is correct. Maybe a little earlier. I am not raising the point critically. I am kind of inquiring for information purposes. Do you have anymore to add?

Colonel BOYKIN. No, sir, other than we are letting the contractor make those trades and he is free to use the Sparrow variant if he decides.

Mr. OLD. You see, you have kind of laid out what all these requirements were to start with and that in essence kind of restricts what imagination is going to be because the contractor says, "I want to be sure I satisfy the customer because otherwise he won't buy my product."

General SLAY. I don't think that this system is in accordance with that portion of the circular the way I read it. The way I read that circular zero based budgeting is related to the requirement. When you go back to base zero you look at everything. Theoretically you could even look at an entirely different system to accomplish that mission, not just an entirely different missile to accomplish that. He might say "I want to throw rocks at him." I don't think that this particular system is in compliance with that portion although I could be wrong. I think you are absolutely right. The services got together and decided what this missile ought to look like, given we are going to have a new missile. I would not be as sanguine that we are in compliance with that although we didn't have to comply with that, Mr. Old, as you understand.

Mr. OLD. We will be quite willing to try to work this out so that we understand it as well. It really was not necessary to try to bail anybody out on that. It is just a good explanation.

Colonel Boykin, what do we get for $81.6 million? That completes the end of the '63 prototype development; is that correct?

Colonel BOYKIN. Yes, sir.

Mr. OLD. Do you have hardware at the end of that time period?

Colonel BOYKIN. There were 22 missiles per contractor, 2 contractors, through that phase. We will have 16 flying missiles of those 22 to shoot at targets. The way I have the thing laid out now is 12 parameters to use those 16 missiles. Of course, there will be a shootoff to try to test the missile against as many of those JSOR goals that I showed on the chart there as possible. Then we will pick a winner based on its success against those parameters.

Mr. OLD. When will that prototype development program be complete?

Colonel BOYKIN. 1980; I have a chart for that if you would like.

Mr. OLD. This is OK. Then to complete all the way through engineering and development what kind of money are we looking at?

Colonel BOYKIN. As I said, we are looking at ways of shortening this program. The schedule I showed you had a first delivery in about 1985 or 1986. We think we can shorten the program somewhat if we can be successful in the prototype phase and can get a couple long lead releases. We are talking about in the $275 to $300 million category for the total program. I can refine that considerably in June when I receive my proposals.

Digitized by Google

Mr. OLD. The funding is between Air Force and Navy?

Colonel BOYKIN. All the dollars are coming through the Air Force line.

Mr. OLD. How was that arrangement handled with the Navy? Do they put their share in?

General SLAY. No; it is direct funding from the Air Force.

Mr. OLD. Is that the way the joint programs work?

General SLAY. That is the way the joint programs work. They did almost all the funding for the R. & D. on the AIM-9, and on the AIM-7. That is the best way to do it.

Mr. OLD. Now a couple of definitions. "WVR" means within visual range and that is the advanced SRAAM; is that correct?

General SLAY. Let us call it missile 1 and missile 2.

Colonel BOYKIN. Beyond visual range implies you can shoot it in weather and at night. You don't have to visually see the target.

Mr. OLD. What is coming out of AIMVAL-ACEVAL that will contribute to the AMRAAM program? Is that program of benefit to this one?

Colonel BOYKIN. As I understand it, and I won't speak for that program, there are two or three areas which are very supportive of Amraam. One is the ability to launch and maneuver, to engage another target. The second is a faster missile, one that gets to the target to allow you to go to another target.

Mr. OLD. Which you mentioned in your briefing.

Colonel BOYKIN. Yes, sir. The third I would say is range, having this midrange that I can fire and then be in a position to fire again.

Mr. OLD. That is more appropriate for the operator to determine requirements rather than you as the program manager?

Colonel BOYKIN. Yes, sir.

Mr. OLD. Could you put your priority chart back up?

[Chart deleted.]

Colonel BOYKIN. Those three things I talked about, terminal mode launch, maximum average velocity is here. The other one was the maximum launch range with a lower priority.

General SLAY. Every one of those is subjective, argumentative, but it was the best the conferees could come up with on laying out the requirements in the JSOR.

Mr. OLD. Under priority three, the column entitled "Aircraft Interface, Multiaircraft Compatible," is there a priority within that priority, that is, the F-14, 15, 16, and 18?

Colonel BOYKIN. No, sir. Just a replacement for the Sparrow on any airplane that can use a radar missile. Our job is to develop a missile that does the job and it has been given no priority as far as aircraft.

Mr. OLD. When will the F-16 be capable of taking the Sparrow?

General SLAY. It won't.

Mr. OLD. You are not planning to mod that aircraft?

General SLAY. It has space, weight, power, and cooling. Right now we have no plans to put the Sparrow on the F-16.

Mr. OLD. This missile would be expected to be compatible with the F-16?

General SLAY. Absolutely. We would hope that we could be smart enough to design a missile/pylon, and I stress pylon, or some sort of arrangement to reduce the drug inherent in carrying the radar missile.

Digitized by Google

Mr. OLD. Admiral Mandeville, does the same apply to the F–18?

Admiral MANDEVILLE. The F–18 is Sparrow compatible.

Mr. OLD. You have no plans at the moment to put the Sparrow on the F–18?

Admiral MANDEVILLE. Yes, sir, it is a Sparrow airplane.

Mr. OLD. And Sidewinder compatible?

Admiral MANDEVILLE. Yes, sir.

Mr. OLD. It is the F–16 that is only Sidewinder?

General SLAY. That is correct.

Mr. OLD. I have no more questions. Thank you very much.

Mr. CROMWELL. In view of the lateness of the hour I suggest that we put the rest of the presentations in the record and I will give you three questions from Senator Cannon to be answered for the record.

[The questions with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR HOWARD CANNON

(Questions submitted by Senator Howard Cannon, answers supplied by Department of Defense.)

Chairman CANNON. The monopulse radar design has been available in various radars for several years. We are of the understanding that there are several ECM techniques which could be used to degrade the performance of monopulse systems. Which of these ECM techniques have been addressed and are considered to be potential threats to the AIM–7F seeker?

Admiral MANDEVILLE. Numerous techniques and combinations of techniques have been addressed during the monopulse evaluation. [Deleted.]

Chairman CANNON. Does the AIM–7F seeker contain engineering features designed to counter any of these techniques?

Captain WELLS. The current [deleted].

Chairman CANNON. Does the proposed fuzing system for the AIM–7F face a potential ECM threat?

Admiral MANDEVILLE. The proposed fuze for the Sparrow improved monpulse seeker is the EX–409. The EX–409 fuze is an active fuze with a surface tracking gate. This gives the fuze a capability as low as 15 feet over the surface of the Earth. [Deleted.]

Chairman CANNON. Could it be prematurely caused to function?

Admiral MANDEVILLE. The probability of prefunction is extremely small.

SUMMARY ON AIR-TO-AIR MISSILES

Mr. CROMWELL. Before we close up, General Slay, and Admiral Mandeville, I would like to request a summary comment on how the air-to-air missile situation is looking because certainly from what we have heard today the 9L Sidewinder looks like a red-hot missile, and the committee has followed for a number of years the development pains of getting it to where it is, but it sure is looking good. Do you see funding plans to bring it into the Navy and Air Force inventories in adequate quantities?

The 7F Sparrow is within its known limitations, certainly highly reliable, and the technical problems that we were talking about last year and the year before have been fixed, according to your testimony today.

The monopulse looks like a tremendous improvement, if that gets funded and goes ahead.

Beyond that the MRAAM looks highly promising.

The Phoenix has a good improvement program.

So the plans and the requirements look in reasonable shape as we sit here. We would like to get your feel for it.

Digitized by Google

General SLAY. I agree a 100 percent with everything you have said, Mr. Cromwell. We are very enthused about the AIM–9L. We are very enthused with the AIM–7F which will replace the AIM 7E which was not too good a missile. My personal goal is to buy as many of both those missiles as fast as we can until we fill up our WRM requirement.

Everything we have seen in our tests convinces me that is the way to go. As far as the tests going on at Nellis now to determine the short range, within visual range concept, I think that is on track. I think it is in good hands. I think that we are going to derive tremendously beneficial data out of that test. I believe that we jointly with the Navy are coming down to the replacement for Sidewinder with a lot more confidence than if we did not have that AIMVAL test behind us. As far as the AMRAAM is concerned I think we are off to a good start. I would just say that from my viewpoint the goal of this committee and the goal of all of us in this business in getting the Navy and the Air Force together has been accomplished. We are together totally and completely and we intend to drive down that road. We just hope that we are allowed to continue on down and come up with a first-class joint pair of missiles to replace two good missiles that we have now.

Admiral MANDEVILLE. I second what General Slay has said. I think of all the areas we have been involved in jointly with the Air Force and probably even alone, we are probably healthiest in the air-to-air programs, near term and with the very good long range planning that has gone on between us and the Air Force. I would certainly echo General Slay's statement that I think we can do a good yeoman's job of getting there and getting the products that we need to fight the air war as long as we are allowed to move ahead and proceed with our plans. They may not be perfect but we think they are solid and we think we are in the right and have good strong air-to-air programs going right now.

Mr. CROMWELL. Thank you very much.

Mr. OLD. General Slay, for the record would you ask your staff to provide the cost to develop pylon and other necessary interfaces to put Sparrow on the F–16?

General SLAY. We will be glad to do so.

[The information follows:]

Approximately 36 months leadtime and $50 million of RDT&E funding would be required to qualify an AIM–7F for carriage and launch. These estimates include the costs of the missiles required for the development program. The procurement cost per aircraft would be approximately $160,000 which includes the cost of all aircraft provisions and pylons for stations 3 and 7. Missile peculiar support equipment is not included. Again, I would like to state, the Air Force has no requirement or current plans to develop an AIM–7F capability for the F–16.

Mr. OLD. For the record, Senator Goldwater and Senator Thurmond have submitted questions to be included in the record. Thank you.

QUESTIONS SUBMITTED BY SENATOR BARRY GOLDWATER

[Questions submitted by Senator Barry Goldwater, answers supplied by Department of Defense.]

Senator GOLDWATER. What is the Air Force's annual requirement to fire missiles for training? How many firings per crew? What kind of inventory assets does that require?

General SLAY. The tactical air forces have just recently submitted annual missile firing requirements for each aircrew. The objectives of this new program

Digitized by Google

will be to validate weapon systems and to establish continuation training requirements for missile firing. These new requirements state that aircrews with a primary mission of air-to-air should fire one AIM–7 and one AIM–9 annually. Aircrews with a primary mission of air-to-ground should fire on of either type missile every two years. Based on the projected tactical fighter forces for fiscal year 1978, it would require 662 AIM–7's and 664 AIM–9's to support this proposal. In addition, Air Defense Command is scheduled to fire 186 AIM missiles in fiscal year 1978 in support of the weapon system evaluation program.

Senator GOLDWATER. How many training firings were made last year?

General SLAY. The Air Force did not fire any missiles purely for training in fiscal year 1976–77T since we currently have a deficit of air-to-air missiles in our WRM stocks. The following missiles were fired in support of the weapon system evaluation program (WSEP):

AIM–7E:	
Fiscal year 1976	233
Fiscal year 1977 transition quarter	60
AIM–9J:	
Fiscal year 1976	233
Fiscal year 1977 transition quarter	65

A part of the WSEP firings is the training that is received by the aircrews who participate and fire in the program.

Senator GOLDWATER. What is the Navy's annual requirements to fire missiles for training?

Admiral MANDEVILLE. The requirement for Sidewinder is one-half missile per fleet fighter pilot per year and one missile for each replacement pilot during training. Attack and reserve pilots are allowed one-fourth missile per year. Regarding the Sparrow, each fleet F–14 and F–4 squadron is allotted eight missiles a year. The F–4 reserve squadrons each receive four Sparrows per year. The Phoenix missile is not fired in training.

Senator GOLDWATER. How many firings per crew?

Admiral MANDEVILLE. Firings per crew average one a year for the fighter pilots and one per tour for the attack aviator.

Senator GOLDWATER. What kind of inventory assets does that require?

Admiral MANDEVILLE. Assets required are [deleted] Sparrows each year.

Senator GOLDWATER. How many training firings were made last year?

Admiral MANDEVILLE. The Navy fired 239 air-to-air Sparrows and 407 AIM–96G/H Sidewinders in fiscal year 1976/TQ.

Senator GOLDWATER. For both services, what improvements have been made in this area since last year? Did Navy fire more training missiles last year than Air Force?

General SLAY. The USAF has recently approved an increase in the number of missiles fired annually to support the Tactical Air Forces (TAF's) request for increased training. Approximately 500 missiles per year are planned for expenditure starting in fiscal year 1978. These expenditures will support both the Weapon System Evaluation Program and the new Aircrew Training Program. Although the TAF had requested 1,300 missiles per year, a decision was made that only 500 missiles could be fired due to the current shortfall in the missile inventory. In addition, we plan to use the older AIM–9E's to support the increased missile firings.

The Navy fired 242 AIM–7's and 387 AIM–9's in fiscal year 1976. A majority of the missiles were fired in support of Aircrew Training. As stated previously, the Air Force fired no missiles for the sole purpose of training. However, the aircrews, who participated in the Weapon System Evaluation Program (WSEP), fired on realistic combat profiles similar to those expected to be seen in combat.

Senator GOLDWATER. Air Force told the Subcommittee last year that $38.1 million would be required in additional funds to conduct a modest missile firing program. This would allow each primary duty fighter pilot to fire one AIM–9 missile each 3 years, for an annual requirement of 881 missiles. What funds are in this year's budget for this training program?

General SLAY. There are no funds in the fiscal year 1978 Budget to procure AIM–9 missiles for the sole purpose of supporting an aircrew missile firing program. [Deleted.] In order to enhance our missile firing program, the Air Force has restructured the Weapon System Evaluation Program (WSEP) to maxi-

Digitized by Google

mize training value. In the cases where WSEP allocations are insufficient to meet the training objective, additional AIM–9E's are allocated for expenditure.

Senator GOLDWATER. How do you certify to the combat readiness of the pilots without an opportunity to live fire? Is this a serious problem?

General SLAY. At the present time the Tactical Air Forces (TAF's) do not have a requirement to live fire a missile prior to being certified Mission Ready. Pilots graduate Mission Capable from the formal Tactical Fighter Training courses and the TAF requires that new pilots upgrade to Mission Ready in their assigned operational unit prior to missile firing. During the upgrade phase of training the Air Combat Maneuvering Instrumentation Range, Dissimilar Air Combat Training, Video Recorders, Gun Sight and Radar Camera Film are used to validate the pilot's performance prior to Mission Ready certification.

Although it might be desirable to live fire a missile prior to Mission Ready certification, current missile inventories will not permit all pilots to fire. Suitable targets, range availability and WRM inventory, driven by fiscal constraints, are all factors which dictate our present procedures of Mission Ready certification.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

(Questions submitted by Senator Thurmond, answers supplied by Department of Defense.)

Senator THURMOND. Last year with the AIM–9L, we discussed the unit flyaway design to cost goal going from $18.2K to $27.2K for 13,000 plus missiles. That was in 1974 dollars.

What are the figures on this program today? Is there anything that should be added to what you provided last year, regarding program cost increases?

Are any anticipated Foreign Military Sales figures into the estimated total missiles required.

General SLAY. The current unit flyaway design to cost goal for the AIM–9L in fiscal year 1976 dollars for 13,000 plus missiles is $34.7K. The current unit flyaway cost estimate in fiscal year 1976 dollars is $34.1K for a total program of approximately 15,000 units. The quantity increase is due primarily to increased Air Force inventory, training and quality assurance evaluation requirements.

Since last year the total procurement program has increased $83.9M due primarily to increased quantities and revised escalation rates.

The proposed program as outlined here does not include any quantities for FMS, [deleted].

Senator THURMOND. I believe several years ago the charter of the defense department air munitions requirements and development committee was strengthened to include air and related munitions. In what way does this committee interface with the various activities of the Navy and the Air Force regarding air-to-air missiles?

General SLAY. The Terms of Reference for the Air Munitions Requirements and Development Commitee (AMRAD) was expanded to include "related" equipment in 1971. However, the committee's cognizance is still limited to programs that fall below the Defense Systems Acquisition Review Council (DSARC) management threshold but the AMRAD Commitee does participate in component commonality decisions for such components as, target detecting devices, safe and arm mechanisms, warhead and seekers. The AMRAD Committee is the DOD focal point for Joint Service Operational Requirements and Joint Development Plans for launcher rails and interfaces to insure interoperability between the various missiles and launch platforms. The Air Force is the lead Service to develop a rail launcher that is compatible with the Beyond Visual Range air-to-air missile and all future air-to-air missiles. This launcher will be used on all late model current aircraft and future aircraft.

Senator THURMOND. What guidance have you received from the Defense Department Committee in regard to the standardization goals reflected in the AMRAAM (Advanced Medium Range Air-to-Air Missile) and AIMVAL (Air Intercept Missile Evaluation)—ACEVAL (Air Combat Evaluation) programs?

General SLAY. Our guidance from DoD has been to insure the interoperability of these proposed missile developments with the Services' newest and planned inventory fighter aircraft.

Senator THURMOND. What consideration has been given towards determining if our allies have suitable air-to-air gun or missile weapons which could be used by the Navy or Air Force?

Digitized by Google

General SLAY. The Air Force has continuing discussions with our allies through the NATO Air Force Armament Group (NAFAG) in an effort to determine whether any of their weapons will satisfy our requirements, both for air-to-air guns and missiles and air-to-surface weapons.

We have evaluated two foreign guns in recent years. One is the Swiss Oerlikon 304 RK 30mm gun which competed unsuccessfully against the U.S. GAU–8 30mm gun for the A–10; the other was the French DEFA 30mm gun which was evaluated for potential applications in an air-to-surface role. We are considering evaluating three other guns systems in the near future, subject to the availability of funds. These are the German Mauser F 30mm and MRCA 27mm guns and the Swiss Oerlikon 831 30 mm gun.

Information available to the Air Force on the UK SRAAM 100, and Skyflash, French Matra 530 and 500, the Itatlian Aspide, and the German Viper has been evaluated. While it has been determined that these weapons do not satisfy our existing requirements, joint interest in the component technologies and efforts to increase interoperability between U.S. and NATO forces continue.

A recent evaluation of a French Aerial Gunnery Tow target has been completed and we are considering procurement of a substantial quantity of these systems for aerial gunnery training and evaluation projects.

Senator THURMOND. Has the U.S. tested the French MATRA Magic air-to-air missile?

General SLAY. No sir. The MATRA Magic missile is physically incompatible with U.S. Air Force and Navy aircraft. The electrical circuits of our aircraft do not mate with the connectors on the MATRA missile. Significant modifications would be required to place the MATRA on our missile launchers.

Senator THURMOND. Some time ago the Air Force experienced considerable problems with caseless ammunition for the GAU–7 gun. What is the current opinion on caseless ammunition as to handling, feeding and firing performance?

General SLAY. Our current position is that the caseless ammunition is unsuitable for use under the environment of tactical air operations. The fire hazard, propagation of fire from one round to the adjacent ones, the effect on muzzle velocity due to environmental factors such as moisture in the air and rain and the difficulty of obturation around the base of the round to prevent escape of high pressure gases are factors that militate against further consideration of the caseless round. The problem of excessive muzzle velocity variation over the temperature ranage of −65°F to 160°F has been solved by redesign of the propellant system and use of a steel cartridge case around the cylindrical body of the telescoped round used in the GAU–7. In the telescoped round the projectile is positioned inside the propellant mass, on the center line.

Senator THURMOND. What effort is being made within your programs to limit the gun ammunition to commonly used caliber measurements?

General SLAY. Our gun ammunition is developed in accordance with established DOD directives which enhance the standardization of ammunition for automatic cannons. The Air Force applies these directives in the development and procurement of all conventional cased ammunition, whereby ammunition in the 20mm to 40mm caliber range are addressed in 5mm increments.

Senator THURMOND. Are the guns being developed for a new aircraft using ammunition which could be standardized in NATO?

General SLAY. The new guns which will emerge from our advanced development program for use on new aircraft will use ammunition which could be standardized in NATO. At the present time there are two production rounds: the NATO standard 20mm M50 series of rounds and the 30mm GAU–8 round which we intend to propose for NATO standardization in May 77. An improved version of the 20mm M50 series is under development. The improved round is physically interchangeable with the M50 series of rounds and therefore usable by NATO countries.

Senator THURMOND. Explain for the Subcommittee the concept of the Liquid Propellant Gun?

General SLAY. The concept of a liquid propellant gun (LPG) differs from a conventional gun which employs solid propellants only in the manner in which the propellant is loaded into the gun breech. In the latter case, the projectile is loaded into the breech, after which the liquid propellant is pumped behind the projectile. The two basic types of conceptual LPGs differ in the manner of loading the propellant; in the bulk-loaded approach, the propellant is introduced behind the projectile through metering valves and ignited in mass; in the re-

Digitized by Google

generative approach, the propellant is fed behind a movable piston which controls the propellant rate of burning. Both of these methods have been tested with varying levels of success. The major problems facing us today is in the area of predictable interior ballistics and in the reliability of key components peculiar to the LPG, such as valves, pumps, and seals.

Senator THURMOND. What is considered to be our best air-to-air short range missile presently in inventory?

General SLAY. The AIM-9L is currently coming into our inventory. The first AIM-9L will begin Follow-On Operational Test and Evaluation in November 1977 and the first missiles will enter the operational inventory in May 1978. When available, the AIM-9L will constitute a significant improvement over the AIM-9J which is presently the best air-to-air short range missile in the Air Force inventory. An improved model of the AIM-9J, the AIM-9J-1, is currently being tested and existing Air Force AIM-9B's and J's are being modified to J-1 configurations.

Senator THURMOND. What has happened to the programs of recent years involving attempts to perfect and improve short range air-to-air missiles?

General SLAY. The Air Force is modernizing its existing Sidewinder inventory to the AIM-9J-1 configuration which in recent testing has demonstrated an improved capability against High G afterburning targets. The Air Force and Navy will soon get into their inventory the all aspect AIM-9L which has demonstrated a substantially greater capability than previous Sidewinder's. In addition Senator, as you are aware, the Air Force and Navy are embarked upon a joint program called Aimval (Air Intercept Missile Evaluation) to determine the performance characteristics needed in future short range air-to-air missile and our technical capability to develop weapons with these characteristics.

Mr. CROMWELL. The prepared statement of Rear Adm. John Alvis, F-14 Phoenix program manager, will be inserted in the hearing record at this point.

PHOENIX BUDGET BRIEF FOR TACAIR SUBCOMMITTEE, SENATE ARMED SERVICES COMMITTEE—BRIEFING PRESENTED BY RADM JOHN ALVIS, F-14/PHOENIX PROGRAM MANAGER

9 MARCH 1977

PHOENIX

BUDGET BRIEF FOR

TACAIR SUBCOMMITTEE,

SENATE ARMED SERVICES

COMMITTEE

Digitized by Google

Good morning, Mr. Chairman and members of the subcommittee, it is indeed an honor and a privilege to brief you today on the Navy's Phoenix program.

9 MARCH 1977

PHOENIX PROGRAM STATUS

- REQUIREMENT
- DESCRIPTION
- MILESTONES
- FORCE STRUCTURE
- PROGRAM COST
- TEST DATA
- SUMMARY

I have structured my presentation to cover the following areas: requirement, description, milestones, force structure, program cost, and test data. I will conclude the presentation with a short summary.

88-379 O - 77 - 6

Digitized by Google

REQUIREMENT

- AIM-54A DESIGNED IN EARLY 60'S FOR THREAT OF 70'S
- DESTRUCTION OF MULTIPLE FIGHTERS AND SUBSONIC BOMBER-SIZED TARGETS
- THREAT INTO 1980'S - 1990'S
  - MULTIPLE, CLOSE-INTERVAL ANTI-SHIP MISSILES
  - WAVES OR STREAMS OF VARIOUS AIRCRAFT
  - ELECTRONIC COUNTER COUNTER MEASURES
- IMPROVED PHOENIX (AIM-54C)

The AIM–54A missile was developed in the early 1960's to meet the threat environment expected in the 1970's. At that time, a viable shipboard point defense system was predicted for the mid-1970's time period and missile targets were assigned to that system. As a result, it was directed that Phoenix would not consider antimissile defense in its design so that there would be no compromise in performance against aircraft targets. This resulted in a long-range missile design optimized for the destruction of multiple fighters and subsonic bomber-sized targets. That capability is now successfully deployed in the fleet via the AIM–54A Phoenix. The current and projected threat for the 1980–90 timeframe includes platforms and weapons not considered in the original AIM–54A design such as multiple, close-interval cruise missiles and waves or streams of various aircraft all of which may be encountered in a severe ECM environment. To meet this expanding threat, the Navy has initiated development of an improved Phoenix (AIM–54C).

Digitized by Google

PHOENIX IMPROVEMENT PROGRAM
MODIFICATIONS AND BENEFITS

deleted

	OPERATIONAL REQUIREMENTS IMPACT	
TARGET DETECTING DEVICE	IMPROVED PK ECCM - CHAFF ALL WEATHER LOW ALT/TARGET SIZE	MTBF = 505 HRS
RECEIVER/ TRANSMITTER UNIT	CRUISE MISSILE DISCRIM - OPENING TARGET CLUSTER THREAT - STREAM RAID BEAM ASPECT - ALL ASPECT	CAPTIVE FLIGHT - 150 HOURS MTBF = 500 HRS CYCLE TIME - 24 MOS PRODUCTION COST SAVINGS DRY MISSILE FAULT ISOLATION PLUS
DIGITAL ELECTRONICS UNIT (INCLUDING AUTOPILOT)	ECCM - VGS IMMUNITY HIGH ALT-M4/90,000 FT LAR IMPROVEMENT GROWTH FLEXIBILITY ECCM GROWTH	CAPTIVE FLIGHT - 105 HOURS MTBF = 430 HRS CYCLE TIME - 6 MOS PRODUCTION COST SAVINGS DRY EU/AP FAULT ISOLATION TEST

The Phoenix improvement program is an upgrade of four selected missile units of the current AIM-54A missile. These four units are the target detecting device, electronics unit, receiver-transmitter unit, and autopilot.

The target detecting device is being redesigned by the Naval Weapons Center, China Lake, Calif., and will incorporate a pseudo noise feature. The improved target detecting device will improve kill probability over a wider threat spectrum, improve capability in rain, and enhance capability in an ECCM environment. Reliability will also be improved.

The improved electronics unit will be digital and will incorporate the autopilot function, increasing capability against [deleted] very high altitude, very fast targets. The unit will be software programmable and possess growth capability. The autopilot will include an inertial reference.

The improved receiver-transmitter unit will be solid state and will incorporate [deleted] to expand capability against opening targets, cluster threats and beam aspect situations.

The improved electronics unit (including autopilot) and the improved receiver-transmitter will also improve reliability.

Digitized by Google

9 MARCH 1977

DESCRIPTION

- SUPERSONIC
- ALL WEATHER
- LONG RANGE AIR-TO-AIR MISSILE
- GUIDANCE
  - SEMI-ACTIVE MID-COURSE
  - ACTIVE TERMINAL
- F-14 SIX MISSILE LAUNCH CAPABILITY

Phoenix is a supersonic, all weather, long range air-to-air missile with semi-active mid-course and active terminal guidance. Six Phoenix missiles can be launched almost simultaneously against six separate targets from the F-14.

9 MARCH 1977

PROGRAM MILESTONES

● NAVY SUPPORT DATE	NOV 1976
● COMPLETE ENGINEERING DEVELOPMENT ON AIM-54C	DEC 1980
● PRODUCTION DECISION ON AIM-54C	JAN 1982

Digitized by Google

The Navy support date for the AIM–54A Phoenix missile was achieved in November 1976. The improved Phoenix (AIM–54C) will provide improved electronic counter counter measures (ECCM) capability in all fleet air defense environments while increasing missile reliability. The design approach will provide new subsystem units which could be retrofitted into the existing missile inventory. Engineering development is planned for completion by December 1980. Production of AIM–54C missiles will commence in January 1982.

9 MARCH 1977

FORCE STRUCTURE

END OF FISCAL YEAR	7T & PRIOR	77	78	79	80	81	82
FLEET DELIVERIES	748	1171	1403	1625	1853	2093	2333
EXPENDED/ATTRITION							
INVENTORY	deleted						

By the end of fiscal year 1977, the Navy estimates that there will be [deleted] AIM–54A production missiles in the fleet inventory.

9 MARCH 1977

PHOENIX PROGRAM COST

($ IN MILLION)

	FY 77 & PRIOR	FY 78	FY 79	FY 80	FY 81	FY 82	TOTAL
● QUANTITY	1752 1/	210	240	240	240	240	2952 2/
● WEAPON SYSTEM COST	727.0	85.3	93.7	121.0	113.2	108.9	1249.1
● INITIAL SPARES	34.7	1.8	3.3	6.4	3.5	2.4	52.1
● RDT&E	175.6	7.1	18.6	40.2	2.4	4.1	247.9
● MILCON	-	1.7	-	-	-	-	1.7
● PROGRAM ACQUISITION COST	937.3	95.9	115.5	167.6	119.1	115.4	1550.8
● PROGRAM UNIT COST	.535	.457	.481	.698	.496	.481	.525

1/ INCLUDES 37 RDT&E MISSILES

2/ INCLUDES 30 RDT&E AIM-54C MISSILES IN FY-80

Digitized by Google

This chart summarizes Phoenix program costs. Since last year's budget submission, our total procurement quantity has increased by 420 missiles in fiscal years 1981 and 1982 as a result of a revision to the Navy's nonnuclear ordnance requirement. Our fiscal year 1978 request to procure 210 missiles is $85.3 million. With the addition of initial spares, R.D.T. & E. and military construction, the total fiscal year 1978 request is $95.9 million.

9 MARCH 1977

TEST DATA

- 152 AIM-54As FIRED FROM ALL PLATFORMS THRU OCT 1976

deleted

- MANY FIRINGS IMPOSSIBLE WITH ANY OTHER KNOWN AIR-TO-AIR MISSILE (RANGE AND MULTIPLE-KILL CAPABILITY)

- 108 PHOENIX FIRED FROM F-14A THRU DEC 1976

deleted

- ONLY REMAINING TESTS ON AIM-54A.....PRODUCTION VERIFICATION LAUNCHES

- DEVELOPMENT LAUNCHES ON AIM-54C BEGIN IN MID -1979

Including the early F-111 development program, 152 AIM-54A's have been fired [deleted]. Many of the Phoenix firings are impossible with any other known air-to-air missile. From the F-14A, 108 Phoenix firings have been made. [Deleted.] The only remaining tests on the AIM-54A missile will be production verification launches. Development launches on AIM-54C missiles will begin in mid-1979.

Digitized by Google

9 MARCH 1977

SUMMARY

- AIM-54C
  - COMPLETE ENGINEERING DEVELOPMENT DEC 1980
  - PRODUCTION JAN 1982
- deleted
- PROGRAM INCREASE OF 420 MISSILES
- deleted

In summary, the Navy expects to complete engineering development of the AIM–54C missile in December 1980. Full rate production of the improved missile will begin in January 1982. One thousand and seventy one AIM–54A missiles will be in the inventory by the end of fiscal year 1977. The current 5-year defense plan reflects an increase of 420 missiles. Firings of the Phoenix missile from the F–14 have resulted in an impressive [deleted] success rate.

Mr. CROMWELL. The prepared statement of Maj. Lanny T. G. Lancaster, Armament Systems Division, Directorate of Operational Requirements, Research and Development, U.S. Air Force, will be inserted in the hearing record at this point.

[The prepared statement follows:]

FY 78 TACTICAL AIR POWER HEARINGS
AIR FORCE GUN SYSTEMS IMPROVEMENTS

BRIEFER: MAJOR LANNY T. G. LANCASTER
ARMAMENT SYSTEMS DIVISION
DIRECTORATE OF OPERATIONAL REQUIREMENTS
DEPUTY CHIEF OF STAFF, RESEARCH AND DEVELOPMENT
UNITED STATES AIR FORCE

CLASSIFIED BY: DIRECTOR, WSEG
EXEMPT FROM GENERAL
DECLASSIFICATION SCHEDULE
OF EXECUTIVE ORDER 11652
EXEMPTION CATEGORY 1
DECLASSIFY ON 1 JAN 2005

Digitized by Google

AIR FORCE GUN SYSTEMS IMPROVEMENTS

- FULL SCALE DEVELOPMENT PROGRAM TO IMPROVE INVENTORY 20 MM SYSTEMS
- ADVANCED DEVELOPMENT PROGRAM TO PROTOTYPE ADVANCED AIR-TO-AIR GUN SYSTEMS

AIR FORCE GUN SYSTEMS IMPROVEMENTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY 78 FUNDING
64603F	AMMUNITION DEVELOPMENT	• INCORPORATE DELAY FUZE • INCREASE MUZZLE VELOCITY • INCREASE HIGH EXPLOSIVE CONTENT	$0.85M
	F-15/F-16 AMMUNITION INTEGRATION	• ENGINEER CHANGES TO THE F-15 AND F-16 FIRE CONTROL SYSTEMS • INTEGRATE HIGH RATE OF FIRE GUN IN F-15	$0.65M

Digitized by Google

AIR FORCE GUN SYSTEMS IMPROVEMENTS

($ IN MILLIONS)

FY 77 & PRIOR	FY 78	FY 79	TO COMP	TOTAL
13.1	1.5	0	0	14.6

AIR FORCE GUN SYSTEMS IMPROVEMENTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY 78 FUNDING
63606F	ADVANCED AERIAL GUN SYSTEM	• PROTOTYPE ADVANCED GUN SYSTEMS OPTIMIZED FOR AIR-TO-AIR	$2.9M
	LIQUID PROPELLANT GUN	• COMPLETE TRI-SERVICE EVALUATION OF LIQUID PROPELLANT GUN TECHNOLOGY	$0.5M

Digitized by Google

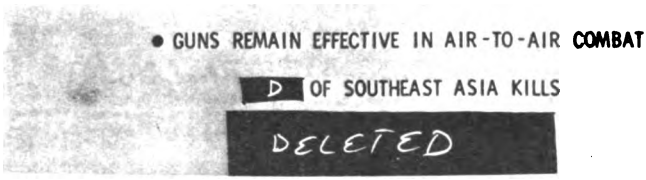
AIR FORCE GUN SYSTEMS IMPROVEMENTS

($ IN MILLIONS)

	FY 77 & PRIOR	FY 78	FY 79	COMP	TOTAL
ADVANCED AERIAL GUN	1.4	2.9	5.3	20.2	29.8
LIQUID PROPELLANT GUN	0.3	0.5	0	0	0.8

Digitized by Google

AIR FORCE GUN SYSTEMS IMPROVEMENTS



Mr. CROMWELL. The prepared statement of Commander Cox will be inserted in the hearing record at this point.

[The prepared statement follows:]

Good afternoon gentlemen; this is a summary of Air Force and Navy research and development air-to-air armament programs for fiscal year 1978. I am Commander Cox and will present Navy programs; and with me is Lieutenant Colonel Trusdale who will discuss the Air Force programs.

AIR FORCE/NAVY AIR-TO-AIR ARMAMENT RESEARCH AND DEVELOPMENT OVERVIEW

OVERVIEW

- 11 PROGRAM - 8 AIR FORCE, 3 NAVY
- 17 PROJECTS
- 8 JOINT AIR FORCE/NAVY PROJECTS
- 1 JOINT AIR FORCE/ARMY/NAVY PROJECT
- 8 UNIQUE TECHNOLOGY/DEVELOPMENT PROJECTS

Digitized by Google

The air-to-air research and development effort includes 11 programs, 8 Air Force and 2 Navy. Of these, eight are advanced development 6.3 programs, two are in engineering development 6.4 programs, and one is funded under product improvement in a 2.7 procurement line. Within these program elements are 17 projects. Joint Air Force/Navy projects account for eight of these and there is one joint Air Force/Army/Navy project. Differing service requirements result in eight technology/development projects that will provide a sound base for satisfying future service-unique hardware developments.

NAVY AIR-TO-AIR ARMAMENT RESEARCH AND DEVELOPMENT PROGRAMS

PROGRAM ELEMENT	PROGRAM TITLE	FY-78 FUNDING
63305N	ADVANCED SHORT RANGE AIR-TO-AIR MISSILE SYSTEM TECHNOLOGY	1.6
63308N	AIR-TO-AIR MISSILE TECHNOLOGY DEMONSTRATION	1.6
64354N	AIR-TO-AIR MISSILE SYSTEMS ENGINEERING	10.4
	TOTAL	13.6

This briefing segment will address the Navy's three 6.3 advanced and 6.4 engineering air-to-air development programs at a cost of $13.6 million. I will discuss the specific projects within the programs.

NAVY AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63305N	ADVANCED SHORT RANGE AIR-TO-AIR MISSILE SYSTEMS TECHNOLOGY	• INITIATE SUBSYSTEM/ COMPONENT TECHNOLOGY INVESTIGATIONS BASED ON AIMVAL ANALYSIS AND OTHER ENGINEERING TECHNOLOGIES. (JOINT AF/NAVY INTEREST).	1.6

The advanced short range air-to-air missile systems technology program is a 6.3 effort that will utilize the results of the AIMVAL tests, other engineering analysis, and technical evaluations as a basis for a decision on the missile characteristics for an advanced short range air-to-air missile development program. The planned fiscal year 1978 program is to initiate a subsystem/component technology phase to support the systems concepts generated as a result of the combat utility test. Initial effort will be the evaluation of Seeker hardware in relation to Seeker sensitivities and off-boresight utilization for acquisition and launch; particular emphasis will be stressed on reliability and availability. The approach is to determine the best features of various Seekers, investigate missile components and systems, and provide information for cost performance trade-offs.

Digitized by Google

NAVY AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63308N	AIR-TO-AIR MISSILE TECHNOLOGY DEMONSTRATION	• TECHNOLOGY BASE FOR ADVANCED AIR-TO-AIR MISSILE SYSTEMS. PRIMARY INTEREST IN SEEKER TECHNOLOGY. (NAVY/AIR FORCE/ARMY INTEREST.)	1.6

Air-to-air missile technology demonstration—a 6.3 effort—is oriented to demonstrate technology at a system level, thereby minimizing the risk associated with including emerging technology in system developments. The technologies associated with this element are either jointly funded by the services or of mutual interest.

In fiscal year 1978, laboratory, anechoic chamber, and captive flight evaluations will be completed to demonstrate the operational capability of an all weather solid state active Seeker.

Also, a passive solid state TV Seeker [deleted] countermeasures.

NAVY AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64354N	AAM COMPONENT ENGINEERING	• PROVIDES A BASIS TO MAKE CERTAIN ENGINEERING CHANGES TO AIR-TO-AIR MISSILE SYSTEMS.	
	SIDEWINDER	VALUE ENGINEERING OF ACTIVE OPTICAL FUSE - IMPROVE GUIDANCE CONTROL SECTION. (JOINT WITH AF/NAVY EXECUTIVE SERVICE).	3.3
	SPARROW	CONTINUE ENGINEERING DEVELOPMENT OF ADVANCED MONOPULSE SEEKER WITH DIGITAL PROCESSOR. FY78 FUNDS ($18.9M) IN AF PE 63316F FOR THIS PROJECT. (JOINT WITH AF/NAVY EXECUTIVE SERVICE).	0
	PHOENIX	CONTINUE DEVELOPMENT ON THE IMPROVED MISSILE DIGITAL ELECTRONICS UNIT, RECEIVER/TRANSMITTER, DIGITAL AUTOPILOT, AND TARGET DETECTION DEVICE.	7.1
		TOTAL	10.4

The 6.4 element, air-to-air missile component engineering provides funds for improvements of short, medium, and long range missiles presently in service. These are represented by the Sidewinder and Sparrow missiles (joint Air Force with Navy-designated executive service) and the long-range Navy Phoenix.

The Phoenix, Sidewinder, and Sparrow improvement programs have been previously presented by RADM alvis, PMA-241, Captain Van Dyke, PMA-259, and Captain Wells, PMA-262.

Digitized by Google

AIR FORCE AIR-TO-AIR ARMAMENT RESEARCH AND DEVELOPMENT PROGRAMS

PROGRAM ELEMENT	PROGRAM TITLE	FY-78 FUNDING ($ IN MILLIONS)
63601F	CONVENTIONAL WEAPONS TECHNOLOGY	5.0
63315F	ADVANCED SRAAM SYSTEMS TECHNOLOGY	1.6
63304F	WITHIN VISUAL RANGE (WVR) AIR-TO-AIR MISSILE	5.9
63310F	ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE (AMRAAM)	42.5
63313F	AIR-TO-AIR ARM (BRAZO)	4.0
63606F	AERIAL GUN SYSTEM	3.4
64603F	IMPROVED AIRCRAFT GUN SYSTEMS	1.5
27161F	TACTICAL AIR INTERCEPT MISSILES	2.6
		66.5

Thank you Commander Cox. I will be addressing the specific objectives of the eight Air Force research and development program elements. Since gun improvements were just briefed I will not discuss the two gun programs. The total fiscal 1978 funding for these programs is $66.5 million. (pause) each program element consists of one or two major projects.

AIR FORCE AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63601F	AIR-TO-AIR TECHNOLOGY	• PROVIDE TECHNICAL BASIS FOR FUTURE SYSTEMS DEVELOPMENT OF A/A MISSILES	2.8
	AIRCRAFT GUN TECHNOLOGY	• ADVANCE GUN SYSTEM COMPONENT TECHNOLOGY	2.2

The conventional weapons technology line supports two air-to-air projects. Under air-to-air technology, the active Laser and fast active radar Seekers are being investigated for application in future dogfight and all weather missiles. Other efforts include a definition study of highly maneuverable missile air vehicle concepts and improved infrared Seeker accuracy with innovative signal processing techniques. The gun technology project will conduct test firings of compact gun mechanisms and continue advanced ammunition concepts. There are joint service interests in both projects.

Digitized by Google

AIR FORCE AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63315F	ADVANCED SHORT RANGE A/A MISSILE SYSTEMS TECHNOLOGY	• PURSUE TECHNOLOGIES TO SATISFY JOINT SRAAM OBJECTIVES. PERFORM TRANSITION TASKS FROM AIMVAL. (AIR FORCE/ NAVY)	1.6

This project is dedicated to the joint Air Force/Navy short range air-to-air missile program and supports the joint air intercept missile evaluation (AIMVAL). Technologies are pursued to satisfy the performance characteristics of the next generation short range missile while emphasizing reduced system cost, support and burden of ownership. A joint service operational requirement will be developed and the Air Force contribution to the joint development effort will be provided by program element 63304F, within visual range air-to-air missile.

AIR FORCE AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63304F	WITHIN VISUAL RANGE AIR-TO-AIR MISSILE	• PREPARE FOR JOINT DEVELOPMENT OF FOLLOW-ON TO AIM-9L. (AIR FORCE/NAVY)	5.9

This new start transitions from program element 63315F, advanced SRAAM systems technology, and supports technology investigations of missile hardware components, and systems to provide the basis for the joint Air Force/Navy within visual range missile development program which will follow. This effort will examine and evaluate design tradeoffs leading to the verification of a joint service requirement as a basis for further development.

JOINT AIR FORCE/NAVY
WITHIN VISUAL RANGE AIR-TO-AIR MISSILE MILESTONES

	FY 77	FY 78	FY 79
AIMVAL FLIGHT TEST	JAN77—MAY77		
OPERATIONAL/TECHNICAL ANALYSIS	JUL77—OCT77		
DRAFT JSOR, ESTABLISH JOINT PROGRAM OFFICE		NOV77	
TECHNOLOGY TRADEOFFS		NOV77—SEP78	
JOINT SERVICE/OSD PROPOSAL TO CONGRESS		FEB78	
DCP/DSARC 1			OCT78
BEGIN ADVANCED DEVELOPMENT			NOV78

Digitized by Google

The planned milestones for the joint within visual range development program are shown here. Air Force and Navy analytical agencies are working jointly to compare AIMVAL flight results with service mission requirements and to perform technical and cost comparisons of the missile concepts that were evaluated. These analyses together with AIMVAL aircrew inputs will be used to develop a draft requirements document. Technology tradeoffs and design verification will be pursued in fiscal year 1978 leading to a joint service proposal a year from now. The spirit of cooperation that exists today gives us a high degree of confidence that a viable missile will result from this proposed program.

AIR FORCE AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63316F	AIM-7F ADVANCED MONOPULSE SEEKER	• INTERIM AIM-7F SEEKER IMPROVEMENT. (NAVY/AIR FORCE)	18.9
	ADVANCED MEDIUM RANGE AIR-TO-AIR MISSILE	• DEVELOP AN AIM-7 FOLLOW-ON MISSILE. (AIR FORCE/NAVY)	23.6

These two projects resulted from the joint air-to-air missile requirements study. The AIM-7F advanced monopulse Seeker was identified as an interim requirement to increase our missile capabilities in electronic countermeasures and low altitude clutter environment. The advanced medium range air-to-air missile responds to a joint service operational requirement for a replacement for the AIM-7 Sparrow. The Air Force leads this project that emphasizes combat effectiveness operational utility, reliability, and compatibility with the F-14, F-15, F-16, and F-18 aircraft.

AIR FORCE AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63313F	AIR-TO-AIR-ARM (BRAZO)	• DEMONSTRATE ANTI-RADIATION SEEKER FOR AIR-TO-AIR MISSILE THAT HOMES ON HOSTILE AIR-BORNE EMITTERS (AIR FORCE/NAVY)	4.0

The Air Force leads this advanced technology demonstration of an Antiradiation Seeker capable of discriminating and tracking the full range of hostile airborne emitters. Suitability for full scale development will be shown by laboratory, captive, and free flight tests. We plan to use this form of passive guidance [deleted] by denying enemy use of airborne radars.

AIR FORCE AIR-TO-AIR ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
27161F	AIM-9L SIDEWINDER	• DEVELOP IMPROVED ROCKET MOTOR (NAVY/AIR FORCE) • INTEGRATE CLOSE CYCLE COOLER (NAVY/AIR FORCE)	2.6

Digitized by Google

Two improvements to the production AIM-9L Sidewinder will result in a more effective missile for tactical employment. The improved rocket motor will contain a propellant which will produce minimum smoke and improved thrust characteristics. The closed cycle cooler will replace the present air battle and cryostat system and will provide unlimited cooling for the missile and simplify the logistic support.

AIR FORCE/NAVY AIR-TO-AIR ARMAMENT RESEARCH AND DEVELOPMENT

JOINT EFFORTS

- JOINT TECHNICAL COORDINATING GROUPS
- JOINT REQUIREMENTS DEVELOPMENT COMMITTEE
- NATO ARMAMENT GROUPS
- TECHNICAL COOPERATIVE PROGRAM

In addition to the joint programs just reviewed, it is appropriate to outline related joint efforts in air-to-air armament. Technical information is exchanged through the tri-service joint technical coordinating groups. The joint requirements development committee considers candidate service programs for possible joint applications. Participation in NATO armament groups and the technical cooperative program are examples of joint international efforts.

AIR FORCE/NAVY AIR-TO-AIR ARMAMENT RESEARCH AND DEVELOPMENT

SUMMARY

- JOINT EFFORTS - 53% OF PROJECTS
  79% OF TOTAL FUNDING
- UNIQUE MISSIONS AND REQUIREMENTS

Overall, joint programs are predominant in this $80.1 million research and development effort. Fully 53 percent of the projects and 79 percent of the total funding are invested in joint endeavors. Unique projects continue to be monitored and reviewed for joint applications through service interest and information exchange.

This concludes the summary of Air Force and Navy air-to-air armament programs. Thank you for this opportunity to summarize our research and development programs for you.

Mr. CROMWELL. Thank you very much. We have had a very fine hearing. The committee will stand in recess until 9 o'clock tomorrow morning.

[Whereupon, at 12:25 p.m., the subcommittee was recessed until 9 o'clock a.m., Thursday, March 10, 1977.]

88-379 O - 77 - 7

Digitized by Google

Digitized by Google

MILITARY PROCUREMENT, FISCAL YEAR 1978

THURSDAY, MARCH 10, 1977

U.S. SENATE,
SUBCOMMITTEE ON TACTICAL AIR
OF THE ARMED SERVICES COMMITTEE,
Washington, D.C.

AIR-GROUND ORDNANCE WEAPONS PROGRAMS

The subcommittee met, pursuant to notice, at 9:23 a.m., in room 212, Russell Senate Office Building, Senator Howard W. Cannon, chairman, presiding.

Present: Senator Cannon.

Also present: Charles Cromwell and Robert Q. Old, professional staff members.

Senator CANNON. The hearing will come to order.

OPENING STATEMENT BY SENATOR HOWARD CANNON, CHAIRMAN

This morning, the subcommittee will review the air-to-ground ordnance weapons programs. We will cover the glide weapons, rocket powered missiles, attack missiles, and also the antiradar missiles. We will not review the Tomahawk or related strategic cruise missiles, as these are covered by the R. & D. subcommittee.

Our principal witnesses this morning are Lt. Gen. Alton D. Slay, Deputy Chief of Staff/Research and Development, Rear Adm. Robert C. Mandeville, Director, Aviation Plans and Requirements DCNO (Air Warfare), Maj. Gen. Abbott C. Greenleaf, Director of Programs, DCS/P. & R.

Now, General Slay, you may proceed.

STATEMENT OF LT. GEN. ALTON D. SLAY, DEPUTY CHIEF OF STAFF/RESEARCH AND DEVELOPMENT, U.S. AIR FORCE; AND REAR ADM. ROBERT C. MANDEVILLE, DIRECTOR, AVIATION PLANS AND REQUIREMENTS, DCNO (AIR WARFARE), U.S. NAVY; ACCOMPANIED BY MAJ. GEN. ABBOTT C. GREENLEAF, DIRECTOR OF PROGRAMS, DCS/P. & R.; BRIG. GEN. ROBERT M. BOND, DEPUTY DIRECTOR OF OPERATIONAL REQUIREMENTS, DCS/R. & D. AND BRIG. GEN. KENNETH A. SMITH, ASSISTANT DEPUTY CHIEF OF STAFF FOR AIR HEADQUARTERS, MARINE CORPS

General SLAY. Yes, sir. Col. Paul Good, who is the program director for Maverick, who is suffering from a little cold ailment, will give the briefing.

Digitized by Google

MAVERICK PROGRAM REVIEW

Colonel Good. Good morning, Mr. Chairman, gentlemen. I hope you will bear with me, because I have lost part of my voice as a result of this cold I have.

Today, I would like to discuss with you the basic Maverick system, as it is the foundation for our development programs and I will discuss the laser Maverick, which is leading to a 24-hour launch and leave capability against designated targets; then the imaging infrared Maverick, our preparations for beginning the full-scale development on that program. I will conclude the briefing with our development and production funds required for those years shown.

OVERVIEW

- MAVERICK SYSTEM
- TV MAVERICK PRODUCTION
- LASER MAVERICK
- IMAGING INFRARED MAVERICK
- DEVELOPMENT FUNDS (FY'78, '79)
- PRODUCTION FUNDS (FY'78, '79)
- SUMMARY

The Maverick weapon system weighs 470 pounds and is 8.2 feet long. It is delivered to the field as an all-up round unit in a sealed container. I have shown here the guidance section, that is made up of the seeker guidance unit, the center section, which includes the warhead, the rocket motor, the thermal batteries; and the aft section, which has a hydraulic actuating unit.

Later in the briefing, when I refer to the center/aft section, I will be talking about everything aft of the guidance section.

In our programs, we have made maximum utilization of this common center/aft section in the Maverick missile for our laser and imaging infrared Maverick. We also make maximum utilization of the commonality of all the support and test equipment.

The Maverick weapon system now is qualified for carriage on the F–4 aircraft, the A–7 and the A–10. It is planned for use on the F–111 and the F–16, and each aircraft is capable of carrying six Mavericks, three on each launcher.

Digitized by Google

The Maverick weapon system was developed as a result of an operational requirement in 1964 for a highly accurate guided air-to-surface weapon for a 24-hour launch and leave capability. The first portion of this requirement was met with the TV Maverick, which gave us a daylight capability.

We have since proceeded with the laser Maverick, which is giving us more of a 24-hour capability against laser-designated targets that I mentioned earlier; and then the new imaging infrared missile is giving us a true launch and leave capability, 24 hours a day, and in some adverse weather conditions.

The versatility of the Maverick is shown here. From release launch altitudes from [deleted] feet and as far away as [deleted] feet slant range against large tactical targets. The utility of the system is shown here by the number of targets on the bottom of the chart that it is capable of attacking.

AGM-65A/B TV MAVERICK

- **PRODUCTION**
  - COMPLETED DELIVERIES OF 6000 MISSILES -FEB'77
  - CURRENT PRODUCTION - FMS PAY BACK
- **OPERATIONS**
  - OPS INCENTIVE FIRINGS- 150/ [deleted] DIRECT HITS)
- **FOREIGN MILITARY SALES (AGM-65A ONLY)**
  - TURKEY-100 DELIVERED
  - SWEDEN [deleted] DELIVERED
  - LETTER OF ACCEPTANCE - [deleted] SAUDI ARABIA
  - LETTER OF OFFER - 200 [deleted]

Since the hearings last year, we have completed deliveries of 6,000 additional missiles with the follow-on option that was completed on schedule last month. We have since initiated a current production program to pay back missiles that were delivered to FMS countries. It is for 2,450 TV missiles through FMS, and was initiated in October 1976. It will carry production through April 1978.

In our operational incentive firing program, in which we actually launched the missiles with operational aircrews, we have launched a total of 41 missiles last year, for [deleted] hits. Our cumulative total today is [deleted] percent direct hits. This is against a requirement of 82 percent in incentive for the contractor.

In the foreign military sales area, we have delivered [deleted] missiles to Turkey and Sweden. We also have a letter of acceptance

Digitized by Google

order for [deleted] missiles, which deliveries will be completed in February 1978.

Currently, we are working a letter of offer from [deleted] for 200 additional missiles.

AGM-65A/B TV MAVERICK PROCUREMENT

(DOLLARS IN MILLIONS)

	FY'77 & PRIOR	78	79	TO COMPL	TOTAL
TOTAL PKG OPT A,B & C	(2000 SCENE MAG)				17,000
FOLLOW-ON OPT	(4000 SCENE MAG)				6,000
FMS BUY BACK	(2450 SCENE MAG)				
FMS (NON ADD)	($150.0)	-	-	-	(5350)
PRODUCTION FUNDS	$407.8	$8.3	$22.8	0.0	$438.9
INITIAL SPARES	$6.4	0.0	0.0	0.0	$6.4
TOTAL	$414.2	$8.3	$22.8	0.0	$445.3

The total package deliveries were completed in November 1975 for 17,000 missiles. The follow-on contract deliveries were completed in February 1977 for 6,000, of which 4,000 of those were the AGM–65B scene magnification missiles.

The FMS buyback procurement I recently mentioned was commenced in October of 1976, and will be completed in April of 1977.

In addition to the 2,450 missiles, we have an option for 350 more missiles, in the event future FMS sales materialize.

Senator CANNON. You said April of 1977. Do you mean April of 1978?

Colonel GOOD. April 1978, yes, sir.

If the [deleted] buy does materialize, they will be bought out of that 350-missile option on this contract. Also, during this time period, we have reduced the production rate to 200 a month.

Our funds requirements for fiscal years 1978 and 1979, as shown here, are for additional AGE and support equipment to support new squadrons coming into the inventory with Maverick capability.

Sir, I would like to go now to the Laser Maverick program. This is a precision guided missile that uses a semi-active seeker to home to a laser-designated target. The proven Maverick airframe is mated with a triservice laser seeker which is under development and for which the Air Force is the executive service.

The Laser Maverick will provide ground commanders with precision close air support firepower nearly 24 hours a day against laser-designated targets.

OPERATIONAL SEQUENCES

Senator CANNON. Tactically, General, what is the operational procedure there for the man on the ground? What is his communication link to the Maverick carrier?

Digitized by Google

General SLAY. Sir, it is a ground FAC that is doing the designating, say, an Air Force FAC or a ground Army FAC. He is in direct contact with the man in the air.

Otherwise, he has to have communications with the forward air controller on the ground or the forward air controller in the air. The FAC has to have some form of communication to be able to communicate the fact that he is spotting the target. Now, that is the official way to do it.

You can also have an aircraft in the air and the FAC can say, there are several laser spots on targets and with Pave Penny—you know, a view—the pilot can look through his hood and pick up the spots. Anytime he sees a laser spot and it is coded properly, he can fire a Maverick at it. That is not the official way to do it.

We would like for the ground laser-designator to be somehow in contact with the man in the air.

Senator CANNON. You have depicted a situation on your chart there. Obviously, that man out there operating the laser is not going to have a communication link, I wouldn't think.

General SLAY. Well, we would normally think that the man with the ground laser-designator would be in contact with the Army—his Army equivalent back at the control station, with the jeep.

That isn't required, Mr. Chairman. You can just designate and use Pave Penny to pick it up.

TRISERVICE LASER SEEKER

Colonel GOOD. Sir, the key to the laser Maverick program is the triservice seeker. This seeker is being developed by the Air Force for use by the Maverick program and will be used by both the Air Force and the Marine Corps. The seeker is also being developed for use by the laser Hellfire. It will also have an application to the GBU–15 program. It is being developed so that a common seeker will be able to be used on all three of these weapon systems. There is a little bit of difference in the commonality of the seeker when applied to the Hellfire program, in that they do require a power supply and also a dome cover for their seeker.

As you can see, our seeker is enveloped in the Maverick front end.

PROBLEMS WITH TRISERVICE SEEKER

Senator CANNON. What are the problems you have run into on the common seeker, the triservice seeker?

Colonel GOOD. Sir, one of the problems that has come up, I believe, is probably the different environments in which they are operating; that is, the helicopter being in the 100- to 150-mile-an-hour flight regime, with the aircraft being in the 600-mile-an-hour range. It has a lot of things that enter into that that influence perhaps what the requirements are to be, and in some cases, maybe are a little more stringent for the laser Maverick.

However, on the other hand, there are other requirements that are driven by the Army requirements, such as a long storage life with a wooden round concept, and also they have a higher G requirement on the seeker itself.

Digitized by Google

So I would just summarize and say that the problem has been trying to optimize the seeker design so it will, in fact, meet both service's requirements.

We feel, to date, that we have a baseline specification established which does meet both services' requirements for the use of the seeker.

Senator CANNON. Are the requirements of either service being compromised as a result of the process?

Colonel GOOD. No, sir. To date, they have not been. I would like to cover that a little bit further in the briefing because I think it——

General SLAY. You are saying both services, but the Navy and Marines are involved, too

Senator CANNON. Yes; I meant all three. He had just referred to the Army and the Air Force.

Colonel GOOD. And I didn't really refer to the Navy and Marines, because their weapon will be identical to ours, sir.

However, since last year's hearings, we have experienced a 1-year slip in the laser Maverick program, due to technical problems which I will discuss later, in the triservice laser seeker.

TRI SERVICE LASER SEEKER

- DEVELOPMENT/TECHNICAL PROBLEMS
  - SIGNAL PROCESSOR REDESIGN REQUIRED
  - SEEKER INSTABILITY IN TERMINAL PHASE
  - EXCESSIVE SEEKER DRIFT
    - SPRING TERM EFFECT
    - TRACKING RATE STATIC ERROR
    - PITCH AND YAW CROSS COUPLING
- SOLUTIONS
  - REDESIGNED SIGNAL PROCESSOR AND SEEKER HEAD ASSEMBLY ELECTRONICS
  - CHANGED MAVERICK GUIDANCE INTERFACE ELECTRONICS
- TEST PROGRESS
  - SIMULATIONS HAVE VERIFIED FIXES
  - FLIGHT TEST

As I mentioned, the technical problems have caused us a 1-year delay in the program. We had design problems that were discovered in the signal processor, where we were getting electronic noise in the signal processor. We found out this was due to poor grounding circuits in the signal processor, so we had to redesign the signal processor.

In the process of doing that, we found out that we had complicated it in such a nature that we were unable to mass produce that particular item, so we were back to the drawing board for a new design which we have at this time demonstrated in simulations.

Digitized by Google

We also found we had some seeker instability in the terminal phase which caused us to use a different guidance technique in the terminal phase.

We originally had a digital linear mode of guidance, where we went into linear guidance in the terminal phase. We found out that that was introducing random signals to the control unit in the Maverick, so we had to reincorporate the digital mode in the terminal phase.

The particular phenomenon that was causing the instability was not present in the digital mode of operation, so we ended up with a digital-linear-digital mode which caused some redesign.

DISCOVERY OF TECHNICAL DEFICIENCIES

Senator CANNON. When did you discover those technical problems?

Colonel GOOD. Those were discovered in the simulations.

Senator CANNON. When?

Colonel GOOD. It started about March of last year. That was when the first hardware item was delivered to the Air Force. Prior to that time, we had no indication from the contractor, and it wasn't until we delivered that hardware, in the February-March time period, gave it to Hughes to put on their Maverick simulation that we found these problems.

Senator CANNON. So you actually found it in March?

Colonel GOOD. Yes, sir. That is when this one turned up, in March, the signal processor problem.

Senator CANNON. What about the others?

Colonel GOOD. They followed shortly after that, after we corrected the signal processor problem. Then we found out that we had more problems in the instability area. That came along about the April-May time period. They kind of followed very closely because it was during that time period that we got our first hardware delivered and were able to put it on a simulation.

Senator CANNON. All right. What I am trying to find out is if you knew it before our hearings last year and if you did, why wasn't it called to the attention of the committee.

Colonel GOOD. Sir, these were really not known before the hearings, I don't believe, last year. I think it was just about that time period that we got the hardware and then these problems surfaced.

See, these units, first delivery hardware, were Government furnished to Hughes—or, excuse me, contractor furnished. So we did not really take delivery on those.

Mr. CROMWELL. Colonel, when I was out at your program office in Dayton in February 1977, you told me then that the first hardware was delivered in February 1976 and that by March, everyone was well aware of these technical problems.

You also told me that the Air Force sent a technical review team to Rockewell on March 21 and 22, 1976, 1 week after our hearings. Now, you didn't discover this problem and then organize a technical review team and set up a review program like that in 1 week.

Of course, you weren't the program manager then, but I believe the point that the Senator was referring to is that the Air Force knew good and well that they had these technical problems when they were up testifying before the subcommittee last year.

Digitized by Google

Now, if I am wrong, I would like to have somebody correct me.

General SLAY. Well, I will correct you as far as I am concerned. I did not know it. Now, maybe somebody in the room did, Mr. Cromwell, but I assure you, I did not when I was here.

Colonel GOOD. Sir, I know that the technical team that was put together was put together very fast with General Partin from ASD who headed it up and went out there.

General SLAY. Well, General Bond participated last year.

Get yourself on the record, Bob.

General BOND. For the record, General Slay and I monitor these programs on a continuing basis. I assure the committee that we were not aware of the significance of the problem.

The teams are put together, after we get this equipment—I am not putting words in the program manager's mouth. We get this equipment and it takes some period of time, No. 1, to identify a potential problem and No. 2, for us to understand the scope of that problem and whether it is easily correctible or not.

I think the record will show—we will go back and I personally will track those dates—that this is one of those transitional periods where a problem had been identified but we did not understand the scope or what it would impact on the program. We, in fact, did not know all of those things at the same time and it was a developing situation rather than a known thing as we appeared before your committee, sir.

Senator CANNON. Go ahead.

OTHER PROBLEM AREAS

Colonel GOOD. Sir, also another problem which came up shortly after that was, we were experiencing excessive seeker drift in the gyro which would cause us to actually exceed the gyro limitations on the missile launch, limiting offaxis launches and also long-range launches.

Those were caused by a spring term effect where we had electrical cable going through the gyro umbilical that was acting like a return spring in one side. We were unable to compensate for that.

We had also tracking rate static errors in which it was just an error built up over time and then we had pitch and yaw cross coupling introduced into it, which we have not been able to compensate for.

Our solutions to these technical problems were a redesign of the signal processor and the seeker head assembly electronics to compensate partially for some of these areas. To complete that compensation, we also made some changes in the Maverick's guidance law which, in effect, prevented the Maverick from ever reaching those large offaxis angles, so that we would never really experience these errors.

That is one case where we took an Air Force requirement that was a hard requirement to make a weapon work on a Maverick, and we did something in the Maverick itself without really driving the cost of the triservice seeker up to a prohibitive cost for the Army, and yet we have still maintained the ability to meet both services' requirements in that seeker.

Since last year's hearings—and this has just been recently—we have put this prototype of the hardware, which we now call block 2 hardware, into the Simfax at Hughes Corp. Simfax is a simulation in which the actual hardware is put into the loop. We have vertified with Sim-

Digitized by Google

fax that these fixes will, in fact, correct the problems we experienced.

We have also had the flight test which has demonstrated to us, too, a certain degree of confidence. However, I would like to point out—and I am about to show you a film of the two launches we have had to date—that the fixes were not incorporated in those two missiles that were launched. The missiles were limited to small, offaxis launches. However, the equipment will be, in the future, flight tested with block 2 hardware which will commence in August of this year.

I would like to show a movie of the two launches we have had.

[A film was shown.]

Colonel Good [narration of film]. We had our first launch on the 15th of January of this year at Eglin Air Force Base on the F–4 aircraft. The missile locked on at about [deleted] feet. The actual launch took place at [deleted] feet, against an armored personnel carrier. This particular weapon was a limited weapon, and did not have a warhead. It was designated by a ground designator, and we will see the targets coming into focus here shortly.

This is a shot of the target, the APC carrier on the right. [Deleted.]

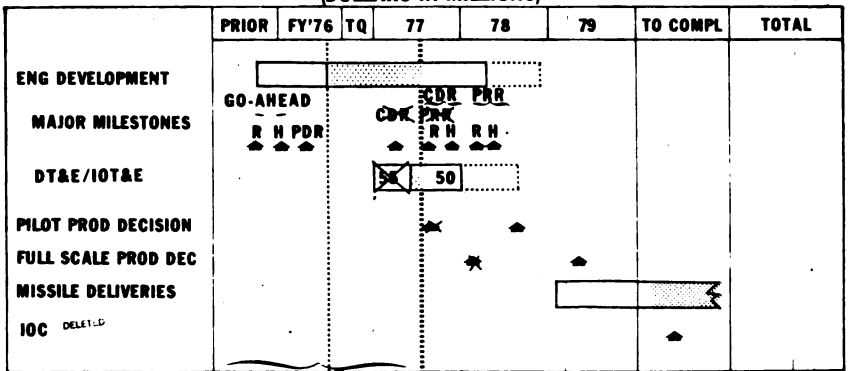
The laser designator was designating [deleted].

Senator Cannon. What was the launch range on that?

Colonel Good. The launch range was [deleted] feet, sir.

Now, the next launch is against a tank [deleted]. That was without a warhead [deleted]. That launch was from [deleted] feet slant range and lockon was at [deleted] feet. Drive angles on both of them were [deleted], respectively.

AGM-65C LASER MAVERICK PROGRAM
(DOLLARS IN MILLIONS)



	PRIOR	FY'76	TQ	77	78	79	TO COMPL	TOTAL
MISSILE QUANTITY	0	0	0	100 /0	2400 /100	2200 /1600	DELETED	
DEVELOPMENT FUNDS	13.5	16.6	6.2	11.2 /11.1	2.2 /9.8	0.0 /0.0	0.0 /0.0	49.7 /57.8
PRODUCTION FUNDS	0.0	0.0	0.0	48.1*/28.9	118.6/37.6	89.9 /78.2	0.0 /97.6	256.6 /242.3
INITIAL SPARES	0.0	0.0	0.0	0.0	1.7 /.5	1.2 /.9	0.3 /.6	3.2 /2.0
TOTAL	13.5	16.6	6.2	59.3/40.0	122.5/47.9	91.1 /79.1	0.3 /98.2	309.5 /302.1

*INCLUDES $26.5M NON-RECURRING TO RESTART PRODUCTION LINE AFTER 22 MO GAP
**PRE BUY OF 1600 MISSILE AFT ENDS
***INCLUDES $9.7 FOR 600 MISSILE AFT ENDS

Sir, I would like to show the program as it was presented at last year's hearings, in which the major point on this was we were contem-

Digitized by Google

plating a 1977 procurement of 100 for pilot production lasers. However, since that time, we have experienced a 1-year delay as a result of the technical problems and that has caused a 1-year slip in the program. We have slipped the engineering development phase out. We have slipped out the D.T. & E./O.T. & E. for a year.

The major thing is, our pilot production decision has slipped out to May 1978. That has, in effect, caused us to move this 100-pilot production from 1977 to a requirement for fiscal 1978.

In addition, our full-scale development decision has moved out to November 1978. Each one of those subsequently has moved the requirement out.

At this point, I would like to depart a bit from the laser Maverick and discuss another program related problem. That problem is shown with our advance center/aft section buy that we are planning to fill the production gap we have as a result of the TV production which completes in April 1978, and the first deliveries of the 100-pilot production laser missiles starting in December 1979.

AGM-65 MAVERICK

CENTER/AFT SECTION PROCUREMENT
(BACKGROUND)

- ORIGINAL PLANNED DELIVERY GAP
  - o LAST YEARS PROGRAM INCLUDED POTENTIAL 22-MONTH DELIVERY GAP
  - o LAST USAF E/O MAVERICK DELIVERY - FEBRUARY 1977
  - o FIRST LASER MAVERICK DELIVERY - JANUARY 1979
  - o AIR FORCE ATTEMPTED TO FILL GAP WITH FMS PAYBACK PRODUCTION
- CHANGES IMPACTING DELIVERY GAP
  - o FMS PAYBACK PRODUCTION OF 2450 MISSILES EXTENDED E/O MAVERICK DELIVERIES FROM FEBRUARY 1977 TO APRIL 1978
  - o TRI-SERVICE LASER SEEKER DEVELOPMENT PROBLEMS DELAYED INITIAL LASER MAVERICK PRODUCTION DELIVERY FROM JANUARY 1979 TO DECEMBER 1979
  - o NET EFFECT - POTENTIAL DELIVERY GAP OF 18-MONTHS REMAIN

At last year's hearings, we did discuss the potential 22-month delivery gap in the Maverick production program. The 22-month gap had been brought about because the last TV Maverick was to be delivered in February of this year and the first laser delivery was planned in January 1979.

The Air Force attempted to fill this production gap with FMS. However, sufficient FMS sales did not materialize. In addition to this action which went on, our attempt to fill that, we also let the contract for 2,450 FMS payback missiles, which is presently on contract and will extend TV Maverick production to April 1978.

Along with this, the triservice laser seeker development problems extended the January 1979 initial delivery out to December 1979. The net effect of all of these actions that took place was that we still have a production gap of 18 months in the program.

Digitized by Google

AGM-65 MAVERICK

CENTER/AFT SECTION PROCUREMENT
(PROGRAM)

- APPROACH TO MINIMIZING GAP IMPACT
  - o FILL 18-MONTH GAP, PLUS 6-MONTH LASER PRODUCTION RATE BUILDUP, WITH PRODUCTION OF 4850 COMMON CENTER/AFT SECTIONS
  - o RETAINS CRITICAL VENDORS UNTIL LASER AND IIR MAVERICK PRODUCTION ATTAINED
- POTENTIAL SAVINGS

	FY78 PRES BUDGET WEAPON SYSTEM COST WITH AFT SECTION BUY	ESTIMATED WEAPON SYSTEM COST WITHOUT AFT SECTION BUY
LASER MAV	242.3M	268.6M
IIR MAV	1431.3M	1442.3M
TOTAL	$1673.6M	$1710.9M

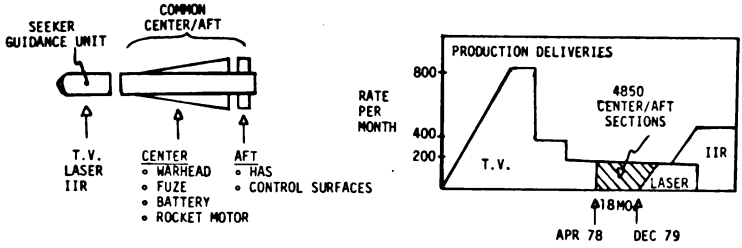
Δ = $37.3M

We have proposed to minimize the effects of this gap by an advance buy of 4,850 center/aft sections for future use in the laser and IIR programs. The thing this does for us, is to maintain a production base of 200 a month for the center/aft sections and prevents a lot of the recurring and nonrecurring gap costs associated with a break in the line.

It also—and more important, I believe—retains these critical vendors until we get into the laser and the IIR systems. One of those, for instance, is a hydraulic actuating system at the aft end which took us a long time and a lot of problems to get them fully qualified.

AGM-65 MAVERICK

CENTER/AFT SECTION PROCUREMENT



PURPOSE

- o TO SUSTAIN CENTER/AFT SECTION PRODUCTION UNTIL LASER MAVERICK ATTAINS PRODUCTION RATE OF 200 MISSILES/MONTH
- o RETAIN CRITICAL VENDORS (ROCKET MOTOR, HAS, THERMAL BATTERY, ETC.) UNTIL LASER AND IIR PRODUCTION

APPROACH

- o FILL 18-MONTH GAP PLUS 6-MONTH LASER PRODUCTION RATE BUILDUP WITH PRODUCTION OF 4850 COMMON CENTER/AFT SECTIONS
- o ASSEMBLE ON LASER AND IIR MISSILES - FIRST IN/FIRST OUT BASIS

PHASING	FY77	FY78	FY79	TOTAL
QUANTITY	1600	2400	850	4850
FUNDING ($M)	28.9*	38.9	13.9	$81.7M

*REPROGRAMMING ACTION (FY77-6N) CONGRESSIONAL NOTIFICATION 24 JAN 1977

POTENTIAL SAVINGS

- o ESTIMATED LASER AND IIR TOTAL PROCUREMENT COST REDUCED BY $37.3M

Digitized by Google

The center/aft section buy would help fill the production gap shown here. Just to refresh your memory a little bit, sir, what I was talking about earlier was the common center/aft section, with the warhead, fuze, battery, rocket motors, hydraulic actuating system and control surfaces are all common with the TV, laser, and IIR missiles.

If the center/aft section buy was terminated, each one of these subvendors will shut down their operations and it will be lost business. It will be a matter of having to restart and requalify each one of those.

We feel that filling this production gap here will permit us to keep those vendors on the line, keep that production base in business and prevent production gap costs. And the savings from that, we feel, will be somewhere on this order.

To do this, what we are asking is that we be allowed to adjust the funding on this program. The action is in front of Congress at this time, to reprogram $28.9 million of the $48.1 million available to us this year for the laser production, reprogram that to buy 1,600 aft sections. Then, in fiscal 1978, we are asking to buy a total of 2,400 center/aft sections, of which those are split up between the IIR and the laser.

In fiscal 1979, we would like to buy 850 center/aft sections for this total of 4,850. These center/aft sections, then, will remain in storage until such time as we can introduce them into our build, and then they will be brought back and mated to guidance units.

EFFECT ON SHELF LIFE

Senator CANNON. Now, does that do anything to the overall shelf life of the missile?

Colonel GOOD. Yes, sir, it will. However, we have figured in the cost to bring these back. We have figured all those in the total program cost, including some refurbishments. It will cut down the shelf life from 2 to 3 years if they are in storage that long.

However, our shelf life—we are still establishing that in our on-going surveillance program. Our design goal is 10 years. We have every reason to believe that we will achieve that currently. With our surveillance testing we have done, it is currently 6 years for the rocket motor and 5 years for the hydraulic actuation system.

We do feel that this is a very important proposal, and we feel that it will save the overall program a great number of dollars, and we strongly recommend the approval of this advanced buy.

Senator CANNON. Now, how will that production be impacted if that letter of offer is negotiated now for a buy. That is not enough to really impact it?

Colonel GOOD. For the 200 that there is, sir, that will give us 1 more month, and we are planning on that already to take us out through the April 1978 time period.

Senator CANNON. Is that the only FMS possibility?

Colonel GOOD. We have one other that we have been requested to provide planning and budgeting data for [deleted] for 150, but here again, that just really fills out a 350 option.

Digitized by Google

IMAGING INFRARED MAVERICK

Sir, I would like to go next to the infrared Maverick. The infrared seeker development has been a joint Air Force-Navy program to date. The infrared Maverick guidance unit is directly adaptable to the Navy extended range Walleye II and will also satisfy the Air Force day/night data-link application requirement for the GBU–15 modular glide bomb series of weapons.

Since last year's hearings, the infrared Maverick program has successfully completed a DSARC II review. It has undergone a critical analysis by the Air Force's studies and analysis organization and we have carried out significant tests to show the improved performance.

IIR MAVERICK IMPROVES FORCE EFFECTIVENESS

- **IMPROVED RESPONSE TO THREAT**
  - **NIGHT AND LIMITED VISIBILITY OPERATIONS**
  - **OPERABLE WITH PLANNED TARGET ACQUISITION SYSTEMS**
  - **UNIQUE DEFENSE SUPPRESSION CAPABILITY**
- **CRITICAL ANALYSIS OF IIR MAVERICK**
  - **SINGLE SEAT OPERATION FEASIBLE**
  - **EFFECTIVE STANDOFF ARMOR KILLER**
  - **ANTI-ARMOR MIX WITH IIR MAVERICK MORE COST-EFFECTIVE**
  - **LESS VULNERABLE TO SOME COUNTERMEASURES**
- **TESTS SINCE LAST HEARINGS**
  - **WILD WEASEL**
  - **SINGLE SEAT OPERATION**
  - **JOINT OT&E**

The approval of the imaging infrared Maverick into full scale development was based upon consideration of all these factors. Sir, if I may I would like—I am kind of losing my voice a bit. I would like to go through this a little rapidly with you.

The systems and analysis study that was completed by the Air Force did show a definite night and limited visibility improvement over the current TV system. We also proved that it was operable and feasible with our planned target acquisition systems. What I am talking about here is the Pave Penny and Pave Tack systems. We proved that compatibility.

It also has a unique defense suppression capability when used with the Wild Weasel aircraft and the APR–38 equipment [deleted].

The studies and analysis people were playing a devil's advocate role, and did an analysis of the IIR. From that, they determined that single-seat employment was feasible and that it was an effective standoff weapon against armor when used with the Pave Tack, Pave Penny systems. It also added flexibility to the use of Pave Penny.

Digitized by Google

We did also conclude that the antiarmor mix with the IR Maverick was more cost effective in fighting the European scenario battle over our current system that we have today. We have also shown that it is less vulnerable to some countermeasures such camouflage, smoke, and things of that nature.

The tests that we conducted since the last hearings were with the Wild Weasel in which, in September of this last year, we demonstrated that suppression capability, flew in with some of the Wild Weasel aircraft and were able to lock on required radar sites, maintain lock on [deleted] with the IIR procedure.

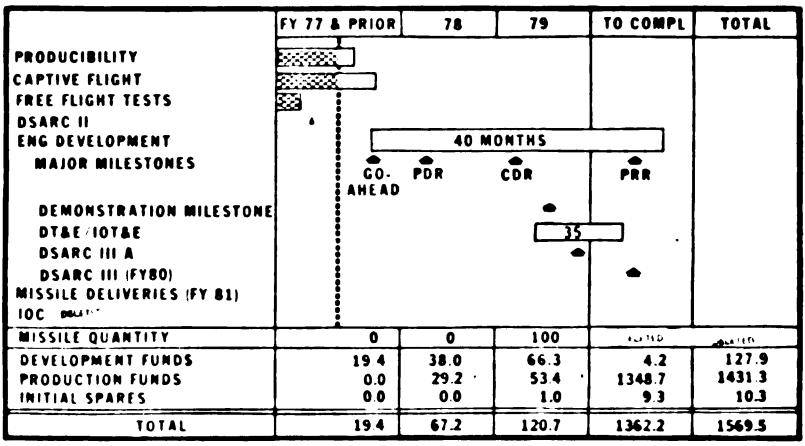
The single-seat operation was tested in two different places; once with the A–7's early flight demonstration in November of last year and most recently, the joint O.T. & E. exercise that we have just completed, in which we flew the IIR missile with both A–10 and A–7 aircraft and did, in fact, verify the single-seat operation.

The joint operational test and evaluation—J.O.T. & E.—phase was conducted as requested by the decision memorandum that gave approval for the IIR Maverick full-scale development. In that J.O.T. & E., we went down to England Air Force Base and flew A–7's and A–10's against the Army's armor units from Fort Polk.

Sir, a typical scenario in which you might use the IIR Maverick would be using a Pave Tack aircraft in which the Pave Tack pod would detect or recognize a target, hand it over to the IIR Maverick, which would launch and leave.

AGM-65D INFRARED MAVERICK PROGRAM

(DOLLARS IN MILLIONS)



MISSILE QUANTITY	0	0	100		
DEVELOPMENT FUNDS	19.4	38.0	66.3	4.2	127.9
PRODUCTION FUNDS	0.0	29.2	53.4	1348.7	1431.3
INITIAL SPARES	0.0	0.0	1.0	9.3	10.3
TOTAL	19.4	67.2	120.7	1362.2	1569.5

* PRE BUY OF 1800 AFT ENDS

** INCLUDES $13.9 FOR PRE BUY OF 850 AFT ENDS

Besides the analysis and testing I have just described that we have completed over the last year in the IIR program, we have also completed an extensive producibility program, in which we were able to drive down the cost of the guidance units by driving down the parts costs.

Digitized by Google

We were also able to confirm some of the IIR seeker/guidance unit shelf life items, and the result was that we do have a savings in life-cycle cost of these components as a result of that producibility study.

The preflight tests have been completed, as you will recall, and we launched four weapons. The engineering development program which we are about to embark on in May of this year is a 40-month program. The milestones are shown here.

Our requirement for funds in fiscal year 1978 will be $38 million to fund the IIR Maverick development effort. In fiscal 1979 we will need $66.3 million to continue the IIR development effort.

Our production funds for fiscal year 1978 are shown here for the center/aft section buy which I mentioned earlier in our center/aft section advance buy approach. And then the fiscal 1978 funds will include $13.9 million for a prebuy of 850 center/aft sections to complete the center/aft section advance buy.

MAVERICK DEVELOPMENT FUNDS

(DOLLARS IN MILLIONS)

FY	77 & PRIOR	78	79	TO COMPL	TOTAL
AGM-65A/B	144.7	0.0	0.0	0.0	144.7
AGM-65C	48.0	9.8	0.0	0.0	57.8
AGM-65D	19.4	38.0	66.3	4.2	127.9
OTHER					
WARHEAD	3.2	6.2	3.8	0	13.2
A/C INTEGRATION	1.9	.9	.1	.2	3.1
SRL	4.3	3.0	0	0	7.3
(NON ADD)					
FDT	(.3)	(.2)	(.2)	(.1)	(.8)
AFTEC	(0)	(.5)	(.4)	(.3)	(1.2)
T&E	(2.5)	(2.7)	(2.7)	(.9)	(7.5)
TOTAL	221.5	57.9	70.2	4.4	354.0

The total Maverick development funds are shown here. I have discussed the funding for the laser and the IIR development programs. Other programs which we have along the way are a warhead program for which we are developing a 250-pound warhead as an alternative to our existing 125-pound warhead. This is being designed to meet a Navy requirement for a larger warhead against larger type targets such as ships and larger-fortified type bunkers and so forth.

Our aircraft integration effort is for the F–16 and F–111. We also have under development a single rail launcher which is a requirement for both the Air Force and the Navy. This single rail launcher, in addition to the use on the Navy aircraft, will be used on the F–16. It will have an application also on the A–10.

Digitized by Google

The development programs in the laser will be finished—and the single rail launcher—in 1978, and the other continuing programs will require a total of $70.2 million in 1979; $57.9 million in fiscal year 1978 will adequately fund us for all of these programs.

MAVERICK PROCUREMENT FUNDS
(DOLLARS IN MILLIONS)

FY	77 & PRIOR	78	79	TO COMPL	TOTAL
TV MAVERICK					
MISSILE QUANTITY	(20,100)	-	-	-	(20,100)
ADVANCE PROCUREMENT	26.8	0.0	0.0	0.0	26.8
PRODUCTION	381.0	8.3	22.8	0.0	412.1
INITIAL SPARES	6.4	0.0	0.0	0.0	6.4
SUBTOTAL	414.2	8.3	22.8	0.0	445.3
LASER MAVERICK					
MISSILE QUANTITY	-	(100)	(1600)	DELETED	DELETED
ADVANCE PROCUREMENT	28.9 *	9.7 *	0.0	0.0	38.6
PRODUCTION	0.0	27.9	78.2	97.6	203.7
INITIAL SPARES	0.0	.5	.9	.6	2.0
SUBTOTAL	28.9	38.1	79.1	98.2	244.3
IIR MAVERICK					
MISSILE QUANTITY	-	-	(100)	DELETED	DELETED
ADVANCE PROCUREMENT	-	29.2 * *	13.9 * *	0.0	43.1
PRODUCTION	-	0.0	39.5	1348.7	1388.2
INITIAL SPARES	-	0.0	1.0	9.3	10.3
SUBTOTAL	-	29.2	54.4	1358.0	1441.6
TOTAL	443.1	75.6	156.3	1456.2	2131.2

* INCLUDES PRE BUY OF 1600 AND 600 MISSILE AFT ENDS IN FY'77 AND FY'78 RESPECTIVELY
* * INCLUDES PRE BUY OF 1800 AND 850 MISSILE AFT ENDS IN FY'78 AND FY'79 RESPECTIVELY

To review the procurement fund requirements in the production area, for the TV Maverick we require, in fiscal 1978, $8.3 million for acquisition of additional launchers support and equipment for new Maverick squadrons coming into the inventory.

We require $38.1 million in fiscal year 1978 for the laser, of which advance procurement is $9.7 million, which I just recently discussed with you.

In the IIR Maverick, our fiscal year 1978 procurement funds are for advance procurement on the center/aft sections. A total of $75.6 million for fiscal 1978 for the Maverick procurement programs.

In fiscal 1979, we will require an additional $22.8 million for TV Maverick launchers and test equipment for new squadrons. We will also require $79.1 million for the laser, which will be for entering into full-scale production.

We will require $54.4 million for the IIR and $13.9 million of that will be for advance procurement of the center/aft sections.

Digitized by Google

MAVERICK PROGRAM SUMMARY

- TV MAVERICK
- AFT SECTION ADVANCE PROCUREMENT
  - RETAINS CRITICAL VENDOR PRODUCTION CAPABILITY
  - REDUCES OVERALL LASER AND IIR COSTS
- LASER MAVERICK
  - SOLUTIONS IN HAND - LAUNCH SUCCESSES
  - MEETING TRI-SERVICE REQUIREMENTS
- INFRARED MAVERICK
  - PRODUCIBILITY STUDIES REDUCED COST AND COMPLEXITY
  - INCREASED CAPABILITY SHOWN
  - PROCEEDING WITH FULL SCALE DEVELOPMENT

I would like to conclude and say that the TV Maverick funds are necessary to procure launchers and support equipment for new Maverick-equipped squadrons.

The advance procurement of missile center/aft sections is important for two major reasons. First, it prevents the loss of critical vendor capability, such as the hydraulic actuation system. Second, the post-gap startup costs for laser and IIR are reduced.

Even though technical problems have been experienced in the laser Maverick program, in the triservice seeker area, causing a 1-year delay, we feel that we do have those solutions well in hand. We have demonstrated in the simulations the fixes to those.

The missile, as a result of the fixes that we have done in the Maverick, is meeting the triservice requirements.

We are now proceeding with full-scale development of the imaging infrared Maverick and we have demonstrated, both by analysis and flight tests that the program will significantly improve the tactical Air Force's capability, with a high-kill probability and a 24-hour capability also.

In summary, we believe that these Maverick development and production programs take maximum advantage of the work already accomplished on the combat-proven TV Maverick missile system. The new laser and infrared systems are complementary and will provide seekers for multiservice applications which will lead to a flexible day/night capability for our tactical forces in the 1980's.

Sir, I thank you for bearing with me. That concludes my briefing.

EFFECTS OF TRISERVICE LASER SEEKER

Mr. CROMWELL. Colonel, is the triservice seeker designed around an Army reuirement for a 6-inch seeker, for the original Hellfire design; whereas the Army now has changed Hellfire to a 7-inch missile?

Digitized by Google

Colonel Good. Yes, sir, we did have that requirement to design to a 6-inch missile. We have designed it to meet that Army requirement for 6 inches.

Mr. Cromwell. But that has changed. The Army program——

Colonel Good. Yes, sir. They have changed, gone to a 7 inch. What we are doing—in a cost-reduction program we have underway today, we are now looking to see if there are any cost benefits to be derived by perhaps looking at the 7 inch as a potential.

Mr. Cromwell. Well, does the earlier, smaller, Army requirement penalize the Maverick design in any way, in cost or performance?

Colonel Good. Sir, I don't think we have really penalized it in performance because we have been able to make up for that in the Maverick guidance equation change.

Naturally, as you package it in a smaller unit, a 6-inch unit, it becomes a lot more dense and, yes, sir, it is going to be more costly and complex than if we were allowed a 12-inch envelope to put it in.

Mr. Cromwell. What is the Army's low-cost seeker that they are looking at? Can you tell us about that effort?

Colonel Good. Sir, I would rather just defer that question to the Army. I am aware of an effort they have going at Microdyne and the Brown-Teledyne labs for an alternative seeker.

Mr. Cromwell. I believe they are working on an alternative seeker which would be only two-thirds of the cost of the triservice seeker.

Colonel Good. I understand that is their goal, yes, sir.

Mr. Cromwell. So apparently there is quite a cost penalty in having these triservice requirements?

Colonel Good. I think that is difficult to really say. We can say what this seeker is going to cost us, but I guess we really don't know what it would have cost us the other way, if you considered all the development cost involved in it.

We feel confident that we are going to be able to meet the Army's DCP thresholds on cost with our cost reduction effort that we have underway today.

Mr. Cromwell. This committee had a series of discussions 3 or 4 years ago, when the Bulldog program was still under consideration, as to whether it would have been desirable to design one laser seeker for the Maverick and the Bulldog and then a separate one to the Army's requirements, since they appeared to be different.

The discussion today seems to indicate that there are some penalties.

Now, you showed those movies of your first two shots. How far away was the laser designator from the tank or the target on those shots?

LASER DESIGNATION FROM GROUND AND AIR

Colonel Good. The laser designator was [deleted] feet away. It was a ground designator, stabilized. We did that to control the test conditions so we would not saturate the seeker and run into some of the instability problems that we knew we had in those early seekers.

Mr. Cromwell. Those were block I seekers?

Colonel Good. Yes, sir, those were block I seekers.

Senator Cannon. What happens—you say that is a ground-held seeker. If the man weaves a little, does the missile follow that weave?

Colonel Good. Yes, sir, somewhat. We are running tests on that now. Our next launch will be sometime next week, which by the way will

Digitized by Google

be a night launch, and will be against a [deleted] spot jerk, and we have mechanized a ground designator to sit there and jump around, give a [deleted] jitter. That seems to be the accepted criterion in those types of ground lasers for the distance that we are talking about.

Senator CANNON. If the seeker is an airborne seeker, he is going to have a difficult time holding on target there, too?

Colonel GOOD. Well, those are stabilized.

Senator CANNON. And they can lock on, then?

General SLAY. Yes, sir. But I don't want to mislead you there. Even though I am thinking of something like Pave Spike or Pave Tack, it is stabilized. But it drifts, and I don't want to mislead you that it is a simple problem. With a little bitty target like a tank, and lasing it from several thousand feet away, it is just like having a long rod at that distance and trying to hold it on something. It is a tremendous stabilization problem, and with a ground-laser designator being hand-held, particularly if the young man that is holding it is under fire, it just might wander around a bit unless there is some means of stabilizing it, like a bench rest on a gun. You can certainly hold a steady sight picture with that. And with a tripod-mounted GLLD, I think you could do the job.

COSTS OF AFT END PRODUCTION PROGRAM

Mr. CROMWELL. The cost charts that you showed indicated that there would be a $37.3 million savings or alternatively, penalty, between keeping the aft end line open and shutting it down. It is correct that the $37.3 million figure actually is $27.3 million, according to the Air Force calculations, and that there was an error made at OSD when they were working up the President's budget?

Colonel GOOD. Sir, we are continuing to exercise that particular aft section buy, in attempting to better optimize the storage time periods, get them down to minimum storage times. There are some inconsistencies in the outyears in the budget, as a result of the way the paybacks were credited back into the program.

But I still feel confident that our total program savings are on the order of somewhere between $37 million and maybe even a little larger than that under our optimized program.

Mr. CROMWELL. When I was out at your program office in February, you gave me the figure $26.3 million savings and explained the error that had been made by OSD's comptroller. I understand that you have changed your figure to $27.3 because of an arithmetical error but that is the last figure I have from you.

Senator CANNON. Do you stand by the $37 million figure?

Colonel GOOD. No, sir, because we are really still massaging the final outyears on that particular program.

Senator CANNON. Well, who stands behind the $37 million figure?

General SLAY. Do you know of a mistake that was made? If so, I think you ought to state it very clearly.

Colonel GOOD. Sir, if I may, I would like to talk a bit about an alternate approach. What perhaps I think would be a smoother flow of the aft sections would be, instead of splitting the center/aft section advance buy between the laser and the IIR the way we have in 1978. I would feel more comfortable if we were permitted to put the total center/aft section advance buy into the laser program in 1977 and

Digitized by Google

1978, not do any center/aft buy—advance buy—on the IIR program until 1979.

I think this does two things for us, if we do it that way. We are able to minimize our storage time, bring it down to a maximum of 2-year storage for the units we buy for the laser and a 1-year storage time for the units we buy for the IIR.

Another thing it does for us is, it keeps us from going out and advance buying center/aft sections for the IIR program which I don't feel we have demonstrated to you people the production readiness requirement for this system.

I feel that in 1979, we will have done that with our test program. It will be a much more viable program to put the aft section buy in at that time.

Senator CANNON. So you are, in effect, telling us that you haven't tested out that IIR program yet and we may not decide to go ahead with it and you would rather buy the other part of the program out. Is that it?

Colonel GOOD. Yes, sir. I would rather buy center/aft sections for the laser, enough to keep our production line going and then I feel we will have enough proof to come back to you and justify the IIR aft section buy in 1979.

Senator CANNON. But isn't the center/aft section interchangeable, though, whichever way you go?

Colonel GOOD. Yes, sir, and I think it is just a matter of trying to keep the funds straightened out.

Senator CANNON. And that shouldn't change the cost, relative to a shutdown and startup. If it is precisely the same, what difference does it make if we decide not to go ahead with the IIR?

Colonel GOOD. If you cut out the IIR portion in fiscal year 1978 that would not buy enough center/aft sections to fill that gap.

General SLAY. Mr. Chairman, I share youre dilemma. I don't understand it either. I think you are right. I don't think it makes any difference but I will certainly check this one out.

Senator CANNON. Take a look at that, and then come back to us with a supplemental answer. I frankly don't see what difference it would make on the ultimate decision.

The only way I can see it would make a difference is, if you are not going to go ahead with the IR or you are not going to increase your numbers, or something else. If you increase your numbers, then you would have to have them.

General SLAY. Quite obviously, if we don't buy the IR, we have got to increase the laser, so I don't think it makes any difference. I think it is six of one or half a dozen of the other.

Senator CANNON. Take a look at that and submit us some supplemental information and also, let's see who stands behind that $37 million figure.

General SLAY. Yes, sir. That is another good question.

[The information follows:]

[COMMITTEE NOTE.—A responsive answer had not been provided by the time the hearing was published.]

Mr. CROMWELL. Now, if you did shut down and then restarted, would you be in a position to have competitive procurement for the components of the aft end, to compete the contracts, when you restarted?

Digitized by Google

Colonel GOOD. If we shut down and then started up again? Yes, sir. I assume they would be competed by the prime contractor, as he has done before.

Mr. CROMWELL. And does the prime have a data package that would allow him to compete those?

Colonel GOOD. Yes, sir.

CARRYOVER OF FISCAL YEAR 1977 FUNDS

Mr. CROMWELL. Now, how much carryover, then, is available from the fiscal 1977 program to fiscal 1978, if the aft end buy goes ahead?

That is the difference between what you want to spend on aft ends and the total amount appropriated last year.

Senator CANNON. I think you had a chart up there that showed it.

General SLAY. It looked like $19.2 million to me.

Colonel GOOD. I guess I am a little confused. I don't totally understand the question on it.

General SLAY. You had $48 million; you are taking $28 million out. You have got about 19-plus left. What happens to that 19-plus? That is the Chairman's question.

Colonel GOOD. Sir, I can't answer that. I think those are reprogramed elsewhere in the Air Force budget for 1977.

Mr. CROMWELL. All right. That is the point. I know the Air Force did hope to reprogram the money.

Senator CANNON. Why don't you put that reprograming chart up there that shows the dollar figure?

Colonel GOOD. Yes, sir. This difference?

Mr. CROMWELL. It is the $19.2, and the Air Force did submit a request to reprogram them, but that has not yet been approved. They may be available for carryover, which would reduce the 1978 requirement.

Colonel GOOD. I guess the only thing I can answer on that, sir, is, it is not in the MAVERICK program.

Mr. CROMWELL. Right. That is done by comptroller.

General SLAY. The R–2 was for $28.9 million, though, was it not?

Mr. CROMWELL. Plus the use for some other areas.

Senator CANNON. The other money apparently was reprogramed elsewhere. That is what it looks like. Either that or there isn't a need for the funds. Either that or we can reduce the funds by that much.

General SLAY. Mr. Chairman, I am incompetent to answer this whole thing, but I will become competent this afternoon and get you a good answer.

[The information follows:]

On January 24, 1977, the Secretary of Defense submitted the MAVERICK Reprogramminig Notification Action (FY 77–6N) to Congress. The reprogramming involves FY 77 funds (Laser MAVERICK—$48.1 million and Space Support/Johnson Island—$0.6 million) to be used as follows:

	Millions
Laser Maverick advance buy (1600 center/aft sections)	$28.9
Defense support program	4.9
Defense meteorological satellite program	3.8
Unapplied fiscal year 1977 congressional reduction—Other missiles, AF	11.1
Total	48.7

Digitized by Google

RELATIVE COSTS OF MAVERICK MISSILES

Mr. CROMWELL. Now, what is the relative cost of the Imaging Infrared Maverick, the Laser Maverick, and TV Maverick? When I was at Hughes, they said that the Imaging Infrared Maverick cost would be a 1.6-factor relative to 1.3 for the laser and 1.0 for the TV. Is that valid on their part?

Colonel GOOD. Right now, our design-to-cost goal on the IIR Maverick is $32,367.

General SLAY. Yes, but that is apples and oranges. You are comparing [deleted] missiles Really, what it is, is 1.0 for a TV; it is 1.20 for a laser; and it is 1.7 for an IIR. That is in constant 1975 dollars, and that is based on a buy of 10,000.

So if you take 10,000 of each and you reduce everything to just apples and apples, it is 1.0, 1.2, and 1.7.

Senator CANNON. So actually, if you go to the 30,000 quantity there on the IIR's——

General SLAY. It would be much cheaper than the laser.

Senator CANNON [continuing]. You ought to bring that down?

General SLAY. Oh, yes, sir.

If you go on our total program in 1977 dollars, the TV Maverick would have cost you $38,000; the laser, with the [deleted] we are buying, is $54,000; and the imaging IIR in 1977 dollars is $37,000; but the quantities are grossly divergent. We have spent a lot of dough. R. & D. wise, on the center and aft sections that the TV Maverick absorbed, and these others aren't charged with that burden.

DESIGNATING LASER TARGETS

Senator CANNON. When you run that test with that shaky laser, inform us of the results of it, will you, because that gives me some concern when I think about it. In the past, I have thought that the laser designator was the answer to a lot of these problems, but now I am not so sure it is, because if you can't put it on there precisely and hold it there, you are going to have him shooting at shadows.

General SLAY. It has got to be well aimed, and if you have got a tank going 15–20 miles an hour down a road, you have to have a good aimer.

Now, you could have the spot wandering all over the place as long as you got it there the instant the Maverick comes; but I agree with you, you have got to test that out and we have got to show it. This business of having a stabilized laser directly on the tank and the tank not moving; that is good for early tests and we need to do that, but eventually, we are going to have to get a foot soldier out there with whatever it is that we are expecting him to use and let him lase that tank as the tank is moving over rough terrain and test it there and see what happens.

Mr. CROMWELL. The Army has done a lot of ground testing with lasers in working up their confidence to prove to themselves that they would change from the Tow to the Hellfire, haven't they?

[The following information was submitted subsequent to the hearings:]

Digitized by Google

The laser Maverick launch using a laser designator with a mechanically induced spot jitter of [deleted] was accomplished on March 18, 1977. The target was a static armored personnel carrier which was parked broadside to the aircraft flight path. The missile was launched from [deleted] ft slant range at an altitude of [deleted] feet and scored a direct hit on the target. This launch was one of six that are planned using Block I laser seekers which do not fully meet Maverick performance requirements. The purpose of this launch was to gather engineering data under very carefully controlled conditions for analysis of the effect of spot jitter on seeker performance. This evaluation is important because in operational use a certain amount of spot wander will always be present due to atmospheric effects, designator stabilization, and operator skill. The [deleted] jitter is representative of the capability of the Army's tripod mounted Ground Laser Locator Designator (GLLD) when placed approximately [deleted] from the target.

Air Force analysis indicates that Laser Maverick effectiveness in the Close Air Support role is dependent on the availability of stabilized ground designators such as the GLLD. The pointing accuracies and stabilization associated with hand held designators [deleted.]

The capability of hand held designators is sufficient for use with laser guided bombs, GBU–15, and Laser MAVERICK against large or static targets. The Air Force also plans to take advantage of the availability and capability of hand held laser designators in conjunction with IIR MAVERICK in Close Air Support. The A–10, and F–16 will be equipped with PAVE PENNY laser spot trackers and the IIR MAVERICK. The hand held designator can be used to designate the desired target or some prominent geographical feature near the target. The PAVE PENNY system will lock-on to the spot and provide electronic signals to slave the IIR MAVERICK head to the location of the laser spot. The target/target area will appear in the cockpit display and the operator then can lock-on to the desired target and launch the missile. This mode of operation will increase [deleted] and it further maintains the true launch and leave capability associated with TV MAVERICK.

Additional, and more critical, investigation of the effects of spot wander on the laser seeker will be accomplished during testing of Block II missiles starting in August 1977. [Deleted.]

LASER USE VERSUS INFRARED

Mr. CROMWELL. One final question. On Tuesday, one of the R. & D. programs that the Air Force was discussing—I think it might have been the single-seat attack—talked about working the problem of acquiring a target through the Pave Penny that a laser was designating and then handing it over to fire an Imaging Infrared Maverick at it.

Why would you fire the more expensive missile if the laser is already on the target?

General SLAY. I asked that question myself at the time the comment was made. If you have got a laser on there and—the only answer is that, in the event of this wandering spot, with an Imaging Infrared Maverick, you don't have to be accurate. You can lase a bush 200 yards away, if you want to. You can just lase the general area, as long as you get it within the field of view of the Imaging IR Maverick, and that is pretty wide.

Yes; they have and I hope I am not giving you the impression that I am pessimistic. I think we can do it but it is not an easy task.

So you could just lase the general area and you don't even need to see the target from the ground; just say, "I know that over this particular hill that I am lasing, there is a tank." But if you are saying, if you have got a good, solid spot on a good, solid target, why not use the cheaper

Digitized by Google

missile? But in the quantities we are buying, of course, it is not the cheaper missile; it is the more expensive missile. But again, our apples and apples comparison is 1.2 to 1.7—it is $1.20 versus $1.70.

Mr. CROMWELL. Thank you, Mr. Chairman.

Senator CANNON. Thank you, Colonel.

Colonel GOOD. Thank you.

Senator CANNON. Senator Thurmond has submitted additional questions for the record.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

(Questions submitted by Senator Strom Thurmond, answers supplied by General Alton D. Slay.)

Senator THURMOND. Why didn't Air Force officials advise the committees in March 1976 of the technical difficulties being experienced with development of the Maverick tri-Service seeker?

General SLAY. The technical difficulties with the tri-Service laser seeker were just beginning to surface in March 1976. The magnitude of these problems were not defined when the MAVERICK program was briefed to the Committees last year. An investigating team was formed during the week of March 25, 1976 to initiate a detailed review of the technical problems. The initial assessment of these problems and program impacts were reported to the Secretary of the Air Force during a May 1976 Program Review. It was not until November 1976 that the problems were fully defined, impacts on seeker versus missile performance were understood, and solutions identified. The solutions identified required restructuring of the program schedules with both contractors involved. Once the impact of the technical problems on cost and schedule were understood, the information was reported to Congress in the President's Budget submitted in January 1977, the supporting R&D Descriptive Summary, and the December 1976 Selected Acquisition Report.

Senator THURMOND. How have these delays impacted on cost of the tri-Service seeker?

General SLAY. The original engineering development contract included a requirement for 160 development seekers, with three production options for Air Force requirements. The initial average target price for the 160 seekers was $7,015 with a ceiling price of $9,095. Changes incorporated to the contract as a result of the seeker problems have increased the target price to $8,921 and the ceiling price to $10,273. Our current cost estimate for Air Force production seekers is approximately $6,400. This price is subject to negotiation as each production option is exercised.

Senator THURMOND. In view of the laser seeker development problems which have been encountered, does the Office of the Secretary of Defense plan to review the program under the DSARC process prior to the beginning of production?

General SLAY. The current Laser MAVERICK program schedule includes a decision milestone in May 1978 to initiate pilot production of the first 100 missiles. We plan to conduct an Air Force Systems Acquisition Review Council (AFSARC) III review of the program at that time and will be prepared to fully support a Milestone III DSARC Review by the Office of the Secretary of Defense prior to exercising the initial production option.

Senator THURMOND. What opportunities exist for tri-Service standardization of missiles, seekers, designators and target acquisition aids?

General SLAY. There are several opportunities for tri-Service standardization and the Services have established a number of different forums to assure either joint or tri-Service program participation as appropriate. The Joint Logistic Commanders (JLC) consist of the Commanders of the development and acquisition commands of the three Services. The JLC has tri-Service working groups that constantly review, study and make recommendations on programs offering standardization opportunities. At the Service headquarters staff level we have Joint Requirements and Development Committee (JRDC) made up of Air Force and Navy flag officers. The charter of the JRDC is to assure that the two Services pursue joint development of air-to-air and air-to-ground munitions where possible. There are also a number of other tri-Service groups that have been

Digitized by Google

established, in concert with the DOD staff, having more narrowly defined areas of interest but with the same goals, i.e., cross Service harmonization where applicable and exchange of technical information. An example is the Joint Service Guidance and Control Committee formed during the past year to facilitate exchange of weapon guidance technical information between the Services and Defense Agencies and to effect coordination of guidance and control technology programs. Some examples of programs that the Services are standardizing are Standard ARM, Shrike, HARM, all air-to-air missiles, tri-Service laser seeker, seeker for laser guided general purpose bombs, and the ground laser target designator program.

Senator THURMOND. Testing of television and imaging infrared MAVERICK missile systems has shown that the pilot of the launch aircraft may not be able to positively recognize the target until he is too close to launch the weapon. At this range, the aircraft is vulnerable to enemy air defenses. Since the Air Force continues to express doubts about the possibility of accomplishing laser designation from the air, and television and imaging infrared guidance may have only limited use for close air support, what other alternative does the Air Force propose for fulfilling its close air support mission?

General SLAY. Recent tests of the IIR MAVERICK missile confirms that the pilot can identify targets by contrast recognition well before the point at which the target can be identified by shape recognition alone. Contrast recognition assumes, and realistically so, that the pilot knows what his target is (such as a formation of tanks and APCs) and based on that knowledge, he can recognize the vehicles by; (1) their regular visual form on the cockpit display screen, (2) their movement, or (3) by the fact that they are firing their weapons.

In over 100 passes flown in the recent test of IIR MAVERICK, only *one* would have placed the attacking aircraft within range of short range air defenses such as the Quad 23, SA–7, or SA–9.

If enemy targets are extremely close to friendly positions, more precise target identification can be accomplished by ground laser designation of the targets for laser seeker/tracker (PAVE PENNY) equipped attack aircraft.

The Air Force approach to close support is a combination of dedicated and multi-role attack aircraft coupled with a wide variety of weapons which range from the simple GAU–8 gun to the more sophisticated IIR MAVERICK. These systems will insure the capability of the Air Force to provide close air support to our ground forces in day, night, and adverse weather conditions.

Senator THURMOND. In November 1976, production of television MAVERICKS was scheduled to continue through May 1978. The earliest delivery of a laser MAVERICK is expected to be November 1979, leaving a production gap of about 18 months at the Hughes plant. Slippage of the laser seeker development schedule has made the Air Force goal of filling the production gap somewhat elusive. The Air Force has proposed procurement of missile bodies to fill the gap in advance of the laser missile procurement schedule. Is it feasible to try to close the production gap at Hughes?

General SLAY. Yes, sir, it is feasible. We plan to continue production through the gap period by building 200 common missile center/aft sections per month for use on future versions of MAVERICK. This approach will sustain the aft section production base until the Laser MAVERICK production rate builds to 200 missiles/month. A gap will occur in the guidance unit assembly line and the cost impacts for this break have been included in the estimated costs for the Laser MAVERICK production.

Senator THURMOND. What real benefits would accrue to the Government if the Air Force procured MAVERICK missile bodies ahead of the laser missile production schedule?

General SLAY. The benefits of continuing production with common missile center/aft sections for use on future versions of MAVERICK are several. From a cost standpoint, continuous production deliveries avoids the non-recurring and recurring cost impact of breaking the center/aft section line and restarting with the initiation of Laser MAVERICK production. An estimated $37.3 million cost avoidance in the total Air Force Laser and IIR MAVERICK production programs is expected to be realized by continuing production of the center/aft sections. An essential benefit to be realized by continuing center/aft section production is that we will be able to retain the critical vendors of the rocket motor,

Digitized by Google

hydraulic actuation system, thermal battery, etc. until Laser and IIR MAVERICK production is attained. Retaining these vendors is equally as important as retaining the center/aft section assembly line at the Hughes plant. Continued production will provide a base for accelerated production in the event of hostilities requiring substantially increased quantities of MAVERICK weapons. Finally, sustaining production through the gap period provides a production base to accommodate requests from our allies for foreign military sales of the MAVERICK weapon system.

Senator THURMOND. What is the risk that changes to the missile bodies would later be required as a result of continued seeker development?

General SLAY. The risk of changes to the missile center/aft section resulting from the Laser and Imaging Infrared seeker developments is considered to be very low. The MAVERICK missiles are being developed as a family of weapons with maximum emphasis on commonality of center/aft sections and support equipment between versions. Our success in maintaining this commonality in our development efforts to date has given us high confidence that changes will not be required later. Starting with TV MAVERICK missile Serial No. 20,001, which was delivered in October 1976, the missile center/aft section incorporated two additional wires to the wiring harness. These two wires are required to pass electronic signals to encode the laser seeker using the aircraft code control panel for the Laser MAVERICK and to provide automatic slaving of the seekers for both Laser and Imaging Infrared MAVERICK. Thus, the center/aft sections currently being produced are common and interchangeable among all seeker-guidance unit versions.

Senator THURMOND. Well planned test results show the degree to which the various Maverick seekers are operationally effective in a close air support, antitank role and when will this information be made available to the Congress?

General SLAY. The Laser and IRR Maverick programs, during their normal engineering development cycle, will go through Initial Operational Test and Evaluation (IOT&E). The purpose of this phase of testing is to define operational tactics for the systems and to assess the system's effectiveness in its intended role. Based on a preliminary analysis of recent operational tests, we expect the future IOT&E testing to support our effectiveness analysis of the IIR Maverick. The recent IIR Maverick tests at Fort Polk showed performance consistent with, and in many cases, almost identical with that reflected in the effectiveness analysis which was provided to the Chairman of Armed Services Committees in February of this year. That analysis addressed the utility of TV and Laser Maverick as well as IIR and pointed out the need for all three versions.

Our preliminary analysis of the IIR Maverick Joint Operational Test and Evaluation has been briefed to OSD and can be made available to Congress at your request. The Laser and IIR Maverick IOT&E tests are scheduled for completion in September 1978 and April of 1980. The results will also be made available at Congressional request.

General SLAY. We have next the GBU–15, Col. Bob Peter, who is the System Program Director.

GBU–15 PROGRAM REVIEW

Colonel PETER. Good morning, Mr. Chairman.

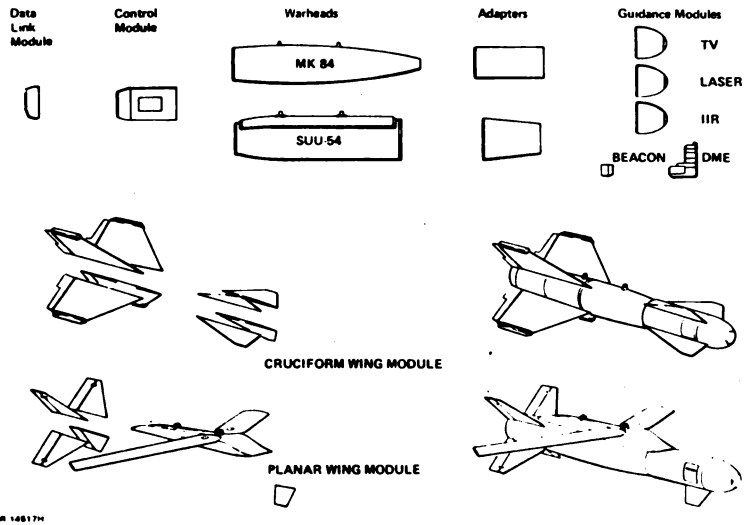
The report you are about to receive is the status of the GBU–15 modular guided weapons system. The GBU–15 combines the electrical guided guide bomb and the modular guided guide bomb into a single weapon system, by using a modular concept.

The GBU–15 program requirement is to provide weapon capability for direct attack; that is, lock-on before launch or indirect attack, lock-on after launch, via data-link, with a 2,000 pound warhead.

The weapon system will be capable of destroying either a point target on an area target in day, night or adverse weather conditions.

Digitized by Google

MODULARITY GBU-15(V)



To achieve the GBU–15 program requirement, a modular approach is used; using baseline modules, two weapon configurations are developed. The cruciform wing weapon is primary for low altitude attack. It is highly maneuverable in either the direct attack or indirect attack mode. The planar wing weapon is primary for long range standoff attack from distances outside the enemy defenses.

The baseline modules for the GBU–15 include the guidance module, MK 84 adapter for point targets with the MK 84 general purpose bomb, the SUU–54 adapter for area targets with the SUU–54 canister, and the control module.

Currently, the baseline modules, including the TV guidance module, are in limited production. The full scale development of the laser guidance module and the imaging infrared guidance module are in the planning stage with the Maverick program office to insure maximum commonality of the seekers being developed in the Maverick program. Either of these modules provides either a day or night capability for the GBU–15 weapon system.

The DME guidance module is designed in conjunction with the ALSS or the PLSS program and allows for a day/night adverse weather capability in both midcourse and terminal guidance.

The beacon module, an off-the-shelf I-band beacon, permits the GBU–15 to be tracked by an airborne B–52 radar and allows the operator of that B–52 to provide midcourse corrections to the GBU–15.

The two warheads, the MK 84 and SUU–54, are presently in the Air Force inventory. The MK 84 is designed for point targets such as bridges, dams and buildings, and so forth, while the SUU–54 is designed for targets that cover large areas such as surface-to-air missile sites.

A third warhead, not shown here, but in advanced development, is the hard structure munition, designed to go against bunkers, caves, et cetera. When the hard structure munition enters full scale development, it will be compatible with the GBU–15 baseline modules.

Digitized by Google

Next, I would like to show how these modules are used to make a weapon system. To attack a target, such as a bridge, from low altitude, the operational commander might select a cruciform TV/data-linked weapon. To build up this cruciform TV/data-linked weapon, the modules depicted on this chart would be used. The weapon would then be assembled.

The operational configuration is depicted on this chart. Here, the assembled weapons are loaded on the aircraft. Shown is one of the actual F–4E operational configurations. Two cruciform wing weapons. TV/data-linked weapons, one on each inboard pylon, the aircraft data link pod on the centerline, and the ALQ–119 ECM pod.

A limited operational capability currently exists in Tactical Air Command for this GBU–15 weapon configuration. It has been successfully deployed in an operational exercise and stands ready for immediate use if required.

The operational concept here shown is a typical tactical mission profile of the TV/data-linked cruciform wing weapon being delivered against a bridge. The pilot releases the weapon at an altitude of [deleted] feet, makes an egress turn. The weapon system operator then guides the weapon to the target via the data link. The weapon can be launched at [deleted] nautical miles from the target at [deleted] feet, .9 mach.

The planar wing weapon employs the same modular concept as the cruciform wing weapon. Shown here is the planar wing weapon in test at the contractor's facility. The planar wing weapon is in integrated test at this time and will begin flight test early this spring.

The wings are folded toward the center when the weapon is carried aboard the aircraft and are extended after release to provide the increased glide capability.

A modular breakout of the B–52 planar wing weapon here is shown. Note that it uses the same baseline modules as the cruciform wing weapon. The I-Band beacon is matched with that B–52 radar.

Senator CANNON. What is the glide ratio there, with those wings?

Colonel PETER. The glide ratio [deleted] sir, once the wings are extended.

A typical B–52 mission profile of the planar weapon here in the sea lane control mission is shown.

[Deleted.]

So far, I have briefly covered the cruciform wing and the planar wing weapon configurations of the GBU–15. I would like to go now into a little bit of the performance.

The performance of the weapon is partly depicted by their launch envelopes. The cruciform wing weapon is shown here. It is capable of [deleted] maneuvers and can be launched as low as [deleted] mach and as high as [deleted] mach at [deleted] feet. Its maximum launch speed is [deleted] mach at high altitude, normally [deleted] feet.

The planar wing weapon is capable of achieving operational ranges in excess of [deleted] nautical miles when launched from [deleted] feet and at [deleted]. Normally [deleted] feet is the minimum launch, to take advantage of the increased standoff capability of the planar wing weapon.

Launched at [deleted] mach, which is the maximum B–52 launch speed, the planar wing weapon will still provide a standoff capability of [deleted] nautical miles.

Digitized by Google

For weapons carriage, the GBU–15 is compatible with the F–4E, the F–111F, and the B–52D. Modification efforts are underway to incorporate data link and weapon capability into these aircraft. The F–4E can carry two GBU–15's and the data link pod in the centerline.

The F–111F can carry four GBU–15's and the data link pod, and the B–52D can currently carry three GBU–15's and the data link pod.

The force structure for the GBU–15 has been identified. Not included in the WRM at this time is the weapon requirement for B–52D. The Air Force will include the WRM for the B–52D when the additional testing with the B–52 is completed.

The Air Force will modify F–4E, F–111F, and B–52 aircraft to provide a GBU–15 weapon delivery capability from standoff ranges. The schedule and funding requirements for the modification program will be discussed later in the briefing.

DEPLOYMENT

- TRANSPORT AND STORE AS MODULES
  - TAC AND SAC
  - CONUS AND OVERSEAS
- BUILD-UP
  - WHEN REQUIRED
  - BASED ON THREAT
- MAINTENANCE
  - WEAPON SYSTEM - 90 DAYS BETWEEN C/O

Digitized by Google

For deployment, the GBU–15 will be transported and stored as a module. Build-up will be accomplished when required and the configuration determined based on the threat. The GBU–15 is designed to go for 90 days between checkouts, after being built up.

CWW TEST PROGRAM

	LAUNCHES	
	PLAN	COMPLETE
MASS SIMULATION	6	6
PRE-PROGRAMMED	6	6
DIRECT ATTACK (TV)	6	6
DME	7	7
INDIRECT ATTACK (TV/DL)	13	5
TOTAL	38	30

Digitized by Google

I would like to move now into the test program and talk about cruciform first and then the planar wing. An orderly process of development was followed in the test program for the cruciform wing weapon. Mass simulation and preprogramed launches were completed earlier in the program and were briefed last year.

Within the last year, however, we have successfully completed the direct attack, the DME testing, and are in the process of completing the indirect attack tests.

The TV/direct attacks were completed and four of the six launches were totally successful. The criteria for success on these six launches was a miss distance of [deleted] feet or less. Two launches had miss distances that exceeded the criteria but they would have destroyed the target had they been live warheads.

The TV guidance module is designed for edge track in the direct attack mode but with data link capability, the weapon could be guided to a direct hit. You see the launch conditions and the altitudes that we have launched the weapon. We have launched as low as [deleted].

FLIGHT TEST RESULTS

		ALT/MACH	RANGE	TARGET	S/U	REMARKS
DME						
26 JUL 76	F-4			POINT	S	
1 SEP 76	F-4			POINT	S	
14 SEP 76	F-4			POINT	S	
21 SEP 76	F-4	DELETED		POINT	S	DELETED
14 OCT 76	F-4			POINT	S	
1 NOV 76	F-4			POINT	S	
6 NOV 76	F-4			POINT	S	

The adverse weather capability of GBU–15 was successfully tested with the cruciform wing weapon using DME guidance, part of the advanced location strike system at White Sands. Both MK 84 and SUU–54 warheads were tested in the program. The CBU–75 is the SUU–54 dispenser filled with BLU–63, BLU–86 bomblets. DME guidance will continue to be tested in the planar wing weapon program.

88-379 O - 77 - 9

Digitized by Google

OPERATION OF DME GUIDANCE

Senator CANNON. How does that DME guidance actually operate?

Colonel PETER. It is from a ground control station, sir. It is a computer on the ground that knows the position of the weapon and through the fact that you have several ground based stations or airborne platforms, you can determine exactly where the weapon is, you know the flight track you want to go through to the target and it is driven from a ground computer that actually flies that weapon.

Once the pilot releases the weapon, he can go home; he no longer——

Senator CANNON. Where do you get the precise location into the computer? Where does that location of your target come from?

Colonel PETER. That can come from several intelligence sources. Of course, in the advanced location strike system, if it is an emitting target, sir, the location capability of the advanced location strike system and the precision location strike system in development would give you those target coordinations of an emitting system.

You can also then take a photo of another type target, a hard target, and you can correlate then also, from a known emitter location and there is a process that you can go through then to determine what those coordinates are.

There are other systems available when you firmly know exact locations; for instance, in the European scenario, the position of strategic targets.

General SLAY. Sir, when I was in Southeast Asia [deleted].

So it is not a new technique, but with PLSS, it would be much, much more accurate than with the GPS. So we'd have the same capability to be ultra-accurate with GPS.

Colonel PETER. On the particular, this distance shown is the centroid of the bomb pattern to the aim point on the ground. Of course, the can is opened anywhere from [deleted] feet above the ground and in all cases, the SUU–54 configuration at that point in time is on the gun's liner within [deleted] feet when the can opened. That, of course, is the difference.

BOMBLET WARHEAD

Senator CANNON. How big is that bomblet in the CBU?

Colonel PETER. It depends on the pattern, so it depends on the altitude that you open it, sir.

At approximately [deleted] feet——

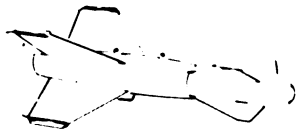
General SLAY. He's talking about the bomblet itself.

Colonel PETER. The bomblet, the BLU–63, is about baseball size, sir.

General SLAY. There's several different kinds but one is softball size and one, the 63, is about baseball size. It is spun up. It spins, in order to arm itself after it's released.

Colonel PETER. The pattern size on the ground, for instance, when we opened it at [deleted] feet above the ground was about [deleted] feet in diameter, sir.

Digitized by Google



FLIGHT TEST RESULTS

		ALT/MACH	RANGE	TARGET	S/U	REMARKS
TV/DATA LINK						
22 NOV 75	F-4			SHIP	S	
28 NOV 75	B-52			SHIP	U	
19 FEB 76	B-52	DELETED		SHIP	S	DELETED
1 OCT 76	F-4			RADAR VAN	U	
18 NOV 76	F-4			TRUCK	U	

The TV/data link CWW testing has not been as successful as we hoped. Three failures have occurred in the launches to date. The weapon logic problem in the autopilot has been fixed. Although we have identified the probable cause of failure for the last two launches, the Air Force contractor team have stopped flight testing and are conducting hardware in-the-loop simulations to verify that corrective actions have been completed. Flight tests will resume shortly and the CWW TV/DL D. T. & E./I.O.T. & E. should be completed by June 1977.

SHIP IDENTIFICATION PROBLEM

Senator CANNON. With your standoff ranges there, for example, from a B-52, how do you identify a ship, determine if it's a friendly or an enemy ship?

Colonel PETER. Again, you can use the high altitude reconnaissance capability that you might have for a sector. This is one thing that can be done if certain areas are identified that there are no U.S. ships or other friendly nation ships in that particular area, and then you can go out and search on radar.

That is one thing you can do and it must be a coordinated effort in conjunction with the Navy that would be worked out.

The one advantage that you do have with the planar wing weapon and the TV data link mode, that if, for some reason, you did launch the weapon, you determine then that the ship that you're looking at

Digitized by Google

is one that you would not want to hit, you can immediately take the weapon and dump it off into the sea.

General SLAY. Electronically, Mr. Chairman [deleted].

PWW TEST PROGRAM

	LAUNCHES	
	PLAN	COMPLETE
MASS SIMULATION	3	3
PRE-PROGRAMMED	7	7
SAC (TV/DL/BEACON)	10	-
TAC (TV/DL)	5	-
(DME)	6	-
(TV/DL/DME)	3	-
TOTAL	34	10

Colonel PETER. The PWW program is following the same logical sequences used in the CWW program. Mass simulation and preprogramed launches have been completed and 10 B–52D launches and 14 F–4E launches are slated for tests in 1977 and 1978.

Digitized by Google

FLIGHT TEST RESULTS

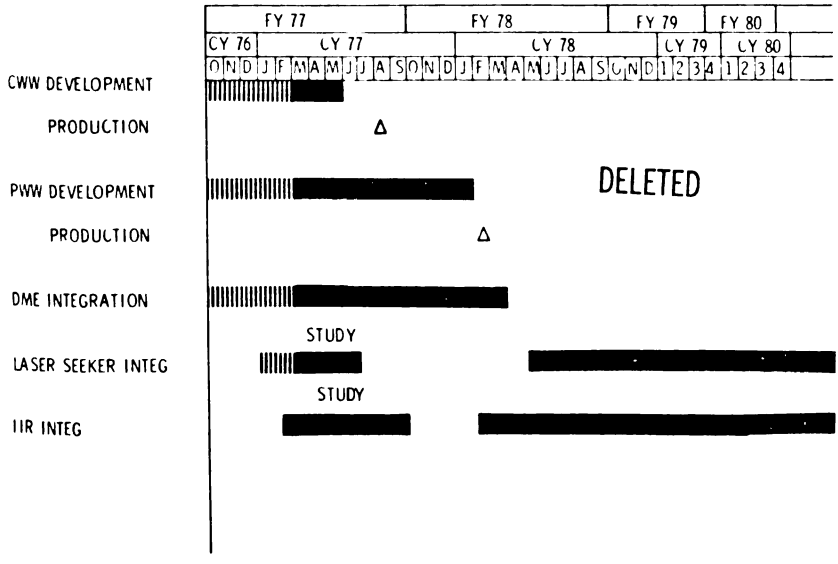
		ALT/MACH	RANGE	PROFILE	S/U	REMARKS
MASS SIMULATION						
7 JAN 75	F-4				S	
13 JAN 75	F-4				S	
15 JAN 75	F-4				S	
PRE-PROGRAMMED						
2 JUL 75	F-4		DELETED	TV/DL	S	
22 JUL 75	F-4			DME	U	ACTUATOR FAILURE
18 OCT 75	B-52			TV/DL	S	BEACON TRACK
14 NOV 75	F-4			DME	S	
26 NOV 75	F-4			DME	S	
13 JAN 76	F-4			DME	S	
8 FEB 76	F-4			TEST	S	

The results of the mass simulation and preprogramed launches were successful. Full-scale engineering development was initiated after these tests were complete. Launch conditions to explore the launch envelope are shown.

General SLAY. I might go back to that previous question. On the first B–52 test against ships in the gulf, from [deleted] miles away, you could see the ship just using the head on the weapon itself by slewing the head from the B–52.

As you get closer in, of course, the scene gets better. Actually, we locked on in that particular instance before the GBU was released from the B–52, so we had a good TV picture.

GBU-15 PROGRAM SCHEDULE



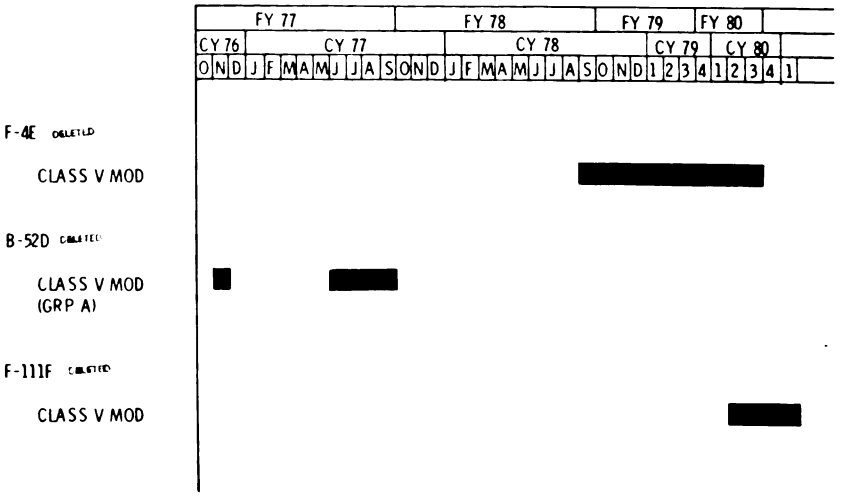
Digitized by Google

Colonel PETER. The CWW TV/DL IOT&E should begin this month. Testing should be completed by June of 1977. We anticipate awarding a contract to establish module rate production for CWW in late calendar year 1977. GBU–15 CWW—TV/DL configuration should enter the inventory in [deleted] PWW flight tests are scheduled to start in May 1977. B–52D flight test will occur first, followed by the F–4 flight test program. Module production is scheduled for early calendar year 1978. The PWW will enter the inventory in the [deleted]. The first [deleted] of the weapons will be allocated to SAC to establish a B–52 limited operational capability. DME integration for the PWW will be completed in March of 1978.

The laser guidance module requirements are presently being defined through an in-house study. The purpose is to define the specifications and operational requirements for its integration into the GBU–15 family. Pending results of the study a full-scale development program could be initiated in fiscal year 1978.

The IIR integration effort is scheduled to be accomplished simultaneously with the Maverick program so as to maximize commonality between the two programs. A study to insure seeker commonality is prepared and ready for contract award. System commonality specifications will be defined in the study and full-scale development will be initiated in fiscal year 1978.

AIRCRAFT MODIFICATION SCHEDULE


FY 77
FY 78
FY 79
FY 80
CY 76
CY 77
CY 78
CY 79
CY 80
O N D J F M A M J J A S O N D J F M A M J J A S O N D 1 2 3 4 1 2 3 4 1
F-4E DELETED
CLASS V MOD
B-52D DELETED
CLASS V MOD (GRP A)
F-111F DELETED
CLASS V MOD

The Air Force plans to modify [deleted] F–4E aircraft. These modified aircraft will be operational beginning in September 1978.

[Deleted] B–52's will be modified to provide a limited operational capability. The first aircraft has been modified and will be used in the test program. [Deleted] additional aircraft will be modified here in 1977. [Deleted] F–111F's will be modified. Modified aircraft then will be available in calendar year 1980.

The aircraft modification schedules are established to consolidate several modification programs into a single program. For instance,

Digitized by Google

the F–4E group A modification will consist of the ARN–101 tactical loran, pave tack, and GBU–15 data link modifications. Also, the F–111F modification will consist of pave tack and GBU–15 weapon system modifications.

GBU-15 RDT&E FUNDING

(THEN YEAR DOLLARS IN MILLIONS)

	FY 77* PRIOR	FY 77	FY 78	FY 79	TO COMPLETE	TOTAL
MODULAR GUIDED WEAPON SYSTEM	$47.8	26.9	12.0	7.0	CONT	CONT
LASER SEEKER	-	-	6.8	9.0	11.5	27.3
IIR	-	1.0	4.5	9.0	33.7	48.2
WEAPON SYSTEM INTEGRATION	7.7	8.6	6.5	6.5	CONT	CONT
JSOR DATA LINK	.4	-	-	.5	TBD	TBD
TOTAL	$55.9	$36.5	$29.8	$32.0	-	-

*DOES NOT INCLUDE FUNDS FROM ASSOCIATED EFFORTS IN PROGRAM ELEMENTS 63741F, 27128F AND 11113F

The R.D.T. & E. funding is shown on this particular chart.

Our fiscal year 1977 efforts have been restructured to expand the CWW flight test program as directed. PWW efforts are continuing with hardware being delivered for an extensive flight test program. Joint hardening efforts with the Navy on the data link were initiated in order to increase the jam resistance of the data link. The F–111F weapon integration is progressing and flight testing of the GBU–15 on the F–111F will occur in fiscal year 1977 and be completed in fiscal year 1978.

In fiscal year 1978 the PWW program will be completed and production will be initiated. Aerospace Ground Equipment integration will continue to include the PWW requirements. Data link hardening efforts will be completed and production of a jam resistant data link to meet the 1980 threat will be initiated in early calendar year 1979.

The IIR full-scale development effort will be initiated also in fiscal year 1978.

This jam-resistant data link effort may impact the laser program in fiscal year 1978, since funds for laser will be diverted to complete jam-resistant data link efforts.

In fiscal year 1979 we plan to continue the IIR and the F–111E/D aircraft integration developments. Additional technologies which have concept validations completed, such as hoj and loran, will begin their integration efforts. Inertial and radiometric area correlator efforts will be available which will expend the GBU–15 capability to provide adverse weather capability.

Digitized by Google

GBU-15 PROCUREMENT PROGRAM FUNDING

(THEN YEAR DOLLARS IN MILLIONS)

	FY 75	FY 76	FY 77	FY 77	FY 78
CWW	$9.6	$20.0	$0	$0	$4.0
PWW	-	-	0	0	$47.0
TOTAL	$9.6	$20.0	$0	$0	$51.0
			QUANTITIES		
CWW	35	120	-	-	-
PWW	-	-	-	-	218
TOTAL	35	120			218

For weapon procurement, since our presentation to you last year, initial WRM requirements have been established. This is reflected in the cost and quantities that you see here and have been perviously mentioned in this presentation.

I'd like to now give you a funding track.

PROCUREMENT TRACK

- FY 75 PRODUCTION FUNDS
  - LIMITED PRODUCTION - DIRECT ATTACK (35 WEAPONS)
  - GFE BASELINE MODULES - PWW (24 WEAPONS)
  - VERIFIED MODULARITY CONCEPT
- FY 76 PRODUCTION FUNDS
  - AIR FORCE REQUIREMENTS CHANGED (CWW/TV/DL)
  - EXTEND CWW TEST PROGRAM (RDT&E)
  - INITIATE RATE PRODUCTION (SEPT 77)
- FY 77 PRODUCTION FUNDS
  - RDT&E FUNDS INCREASED
  - PRODUCTION FUNDS NOT APPROVED
- FY 78 PRODUCTION FUNDS
  - WEAPON DATA LINK (CWW)
  - CONTINUE BASELINE MODULE
  - INITIATE PWW MODULES

Digitized by Google

In fiscal year 1975, the fiscal year 1975 production funds were used to initiate a limited production of CWW/TV direct attack. In addition, baseline modules were produced for the PWW full-scale development program. The integration of the baseline modules into both the CWW and the PWW weapons has verified the modularity concept for the GBU–15 program.

In fiscal year 1976, Air Force requirements for direct attack weapons were changed to add the weapon data link, thereby increasing the operational flexibility of the GBU–15 CWW weapon systems. The flight test program was expanded to demonstrate this capability. CWW TV/DL testing has been delayed because of technical difficulties but will be completed by June of 1977. These fiscal year 1976 funds will be used to initiate module rate production in September of 1977.

In fiscal year 1977, production funds for fiscal year 1977 were deleted and additional fiscal year 1977 R.D.T. & E. funds were provided to accomplish additional testing.

In fiscal year 1978, procurement funds will be used to procure weapon data links for the CWW weapon. And in addition to continuing the baseline module production being started in September of 1977, initial production of the PWW weapon modules will be started. Production will then continue into the outyears until the WRM has been completed.

AIRCRAFT PROCUREMENT FUNDING

MODIFICATION/PODS

(THEN YEAR DOLLARS IN MILLIONS)

	FY 77 & PRIOR	FY 77	FY 78	FY 79	TO COMPLETE	TOTAL	(QUANT)
MODIFICATION							
F-4E	$ .6	$ .3	$ .2	$ -	$ -	$ 1.1	[illegible]
F-111F	-	-	10.1	21.4	29.9	61.4	[illegible]
B52D	.4	-	-	-	-	.4	[illegible]
TOTAL	$ 1.0	$ .3	$10.3	$21.4	$29.9	$62.9	
PODS							
F-4E	$ .9	$ -	$ 2.5	$ 4.4	-	$ 7.8	[illegible]
F-111F	-	-	.3	1.4	3.6	5.3	[illegible]
B-52D	-	4.7	-	-	-	4.7	[illegible]
TOTAL	$ .9	$ 4.7	$ 2.8	$ 5.8	$ 3.6	$17.8	

For aircraft modifications, the R. & D. funds for aircraft integration efforts and the flight test programs have been identified. Aircraft modification funds to provide the GBU–15 operational capabilities are programed. The [deleted] F–4E, the [deleted] F–111, and the [deleted] B–52D aircraft are in the current budget. These modifications will give the Air Force a guided weapon capability from standoff ranges outside the enemy defenses. In addition, the capability of the CWW will provide the tactical forces with a guided weapon capability at low altitudes.

Digitized by Google

SURFACE DEFENSE SUPPRESSION

(GBU-15)

CAPABILITY	APPROACH
STAND-OFF ATTACK:	GLIDE FROM HI ALTITUDE (PLANAR)
	GLIDE FROM LOW ALTITUDE (CRUCIFORM)
NIGHT ATTACK:	LASER GUIDANCE
	IMAGING IR GUIDANCE
ALL WX ATTACK:	DME GUIDANCE
LARGE TARGET SPECTRUM:	TROOP CONCENTRATIONS (CLUSTER)
	STRUCTURES (UNITARY)
	BUNKERS (HARD STRUCTURE MUNITION)

In summary, the GBU–15 modular guided weapon system is the and 2,000-pound-class weapon being developed to provide a unique capability at both high and low altitudes at night, compatible with the ALSS/PLSS strike system, thereby providing an adverse weather strike capability. It provides for future integration of technologies at minimal cost on a modular basis, and is capable of destroying a large spectrum of targets, troops, structures, bunkers and so forth.

Gentlemen, that completes my briefing, and I thank you.

COSTS OF GBU–15 WEAPON

Senator CANNON. What is going to be your total program cost, your unit production cost?

Colonel PETER. With the WRM quantity at something slightly less than [deleted], our average unit cost across the spectrum, all weapon configurations, comes out to about [deleted].

Senator CANNON. Is that without your requirements for the B–52's?

Colonel PETER. Yes, sir. The WRM requirement does not include the B–52's. We will include the B–52 WRM requirements upon completion of the test programs. Currently, 30 weapons are identified to go to limited operational capability.

Senator CANNON. What did you say the cost was again?

Colonel PETER. [Deleted.] Yes, sir, that includes the nonrecurring shipping containers, the tech orders, et cetera, full costs.

Senator CANNON. Now do you provide a greater number of subcomponents than the weapons systems that you show there?

Digitized by Google

Colonel PETER. Yes, sir. Those were the major modules. Included, for instance, in the control module are such things as BD gyros, the full gyros, the batteries. Those are included in it, sir.

Senator CANNON. The extras and spares are all included in your [deleted].

Colonel PETER. Yes, sir.

Senator CANNON. OK. Thank you.

General SLAY. Sir, Capt. Ed Barrineau will talk about Walleye next.

WALLEYE PROGRAM REVIEW

Captain BARRINEAU. Good morning, Mr. Chairman. I am Capt. Ed Barrineau, from the Naval Air Systems Command. I'm the project manager for the Defense Suppression Systems. My office was formerly concerned with only the antiradiation missile project; however, we have since included additional programs, one of which is Walleye. I would like to discuss it now. I will return later in the morning to brief the Harm missile.

The urgency of the operational requirement to attack defended targets with tactical aircraft without the risk associated with deep penetration of enemy defenses is of continuing concern. The Walleye weapon system is the only standoff air-to-ground capability available to Navy tactical air today against nonradiating targets.

Walleye is a glide bomb which employs electro-optical guidance. The basic Walleye I utilized an 800-pound warhead. Employment of the system required the pilot to lock onto the target prior to weapon launch. After the weapon left the aircraft, the pilot had no capability of updating the aimpoint, or of correcting the weapon's flight path. Even with those limitations, Walleye proved to be an effective weapon in combat.

In order to enhance Walleye's effectiveness, a conversion program was instituted which increased the warhead size from 800 pounds, Walleye I, to 2,000 pounds, and this we call Walleye II. Thus, within the accuracy limits of Walleye's guidance section, it's destructive capability increased substantially. However, delivery of either Walleye I or Walleye II required that the delivery aircraft enter the surface-to-air missile envelop of enemy defenses.

Consequently, a data link conversion program was instituted which enables the pilot to see what the weapon's guidance section observes between release from the delivery aircraft and target impact. In addition, the data link system permits the pilot to control the weapon after launch, through a command link, which provides right and left or up and down commands after the weapon is launched. During this conversion program, we also added what we call an extended range kit, which allows delivery of this weapon from a range of [deleted] nautical miles at an altitude of 40,000 feet. In practical terms, either Walleye I or II with the extended range data link kit installed can be launched from its primary delivery aircraft, the Navy A–7, at a range of [deleted] nautical miles from an altitude of 20,000 feet. The extended range data link system was approved and funded for installation in the Walleye II weapon and is currently deployed in [deleted] aircraft carriers. By July of this year, a total of [deleted] carriers will be simultaneously deployed with this significant capability.

Digitized by Google

Tactical employment of extended range data link Walleyes can be accomplished by single aircraft delivery and control of the weapon after launch, or by having one aircraft deliver the weapon, and a second aircraft control it after it has been launched.

ER/DL WALLEYE I & II CONVERSION STATUS & PLANS

FY 75 - 170 ER/DL WALLEYE II - CONVERSION COMPLETE 10/76

FY 76 - 430 ER/DL WALLEYE II - CONVERSION NOW UNDERWAY - DELY. 9/76 - [illegible]

FY 7T - 100 ER/DL WALLEYE II - CONVERSION NOW UNDERWAY - DELY. [illegible]

FY 77 - 480 ER/DL WALLEYE II - CONVERSION NOW UNDERWAY - DELY. [illegible]

1180 TOTAL FUNDED

FUTURE PLANS

	FY 78	FY 79	FY 80	FY 81	FY 82
ER/DL WALLEYE II	190	-	-	-	-
ER/DL WALLEYE I *	345	539	516	526	505
OPN FUNDS ($M)	16.0	17.0	17.0	18.0	18.0

* WILL UTILIZE WEAPONS TRANSFERRED FROM USAF

If I can turn now to our 5-year defense plan, the fiscal year 1978 budget specifically requests funds to convert 535 Walleye weapons to the extended range data link configuration. This request is a continuation of the program approved by the Congress in fiscal year 1975 for 170 units, in fiscal year 1976 for 430 units, in the transition period for 100 units and in 1977, for 480 units.

In fiscal year 1978 we will commence converting Walleye I to the extended range data link configuration also, using the same data link system that we have used in the Walleye II.

OBLIGATION PLAN FOR REQUESTED FUNDS

		FUNDS $M			
ITEMS	SOURCE	FY 76	FY 7T	FY 77	FY 78
DATA LINK COMPONENTS	INDUSTRY	7.1	1.7	7.5	10.2
ER WINGS AND CONTAINERS	INDUSTRY	1.0	.3	1.4	1.5
GUIDANCE AND CONTROL SECTION MODIFICATION AND CONVERSION	NAFI	1.3	.3	1.7	2.2
SUPPORT AND TEST EQUIPMENT	NAFI	1.3	.5	2.3	1.4
WEAPON ASSEMBLY AND TEST INTO AUR CONFIGURATION	NWS	.4	.1	.5	.7
		11.1	2.9	13.4	16.0

Digitized by Google

If our request for $16 million is approved, the funds will be expended as shown on this Vugraph. The majority of funds go to industry for procurement of transmitters and receivers for the data link and procurement of wings and containers for wings and fins. In-house expenditures include the costs of component modifications to accept the data link configuration, cost of assembly, test, and delivery at the Naval Weapons Station at Yorktown and Fallbrook.

A-7 AIRCRAFT CHANGE KIT AND DATA LINK POD FUNDING-$M

	APN	PROVISIONS KITS	CONTROLLER KITS	QUANTITY PODS
FY 75	2.6	258	50	25
FY 76	2.5	40	27	25
FY 77	.8	0	40	5
FY 78	2.1	92	163	5
FY 79	1.7	25	135	0
TOTALS	9.7	415	415	60

In addition to the OPN funding provided by the Congress in earlier years, fiscal year 1975, fiscal year 1976, fiscal year 1977 and fiscal year 197T for conversion of weapons. APN funding was provided for procurement of 55 airborne missile control system Pods and a quantity of A-7 airframe change kits and avionics changes. In fiscal year 1978 we would like to procure additional kits and five more Pods. If the program is continued to completion, the total aircraft and Pod quantities in the inventory will be as shown here.

	WALLEYE INVENTORY	
	ON HAND 2-28-77	PLANNED END FY 82 CONVERSION PROGRAM
WALLEYE I	DELETED	DELETED
WALLEYE I (ER/DL)	DELETED	DELETED
WALLEYE II	DELETED	DELETED
WALLEYE II (ER/DL)	DELETED	DELETED

* INCLUDES 2252 WEAPONS TRANSFERRED FROM USAF

Digitized by Google

The quantity of Walleye weapons now on hand and the quantity expected to be on hand after completing all the conversions planned through the end of fiscal year 1982 program are shown in this Vugraph.

WALLEYE FUTURE FUNDING - $M

	RDT&E	OPN
FY 78	2.1	16.0
FY 79	3.1	17.0
FY 80	4.9	17.0
FY 81	4.8	18.0
FY 82	15.6	18.0
TOTALS	30.5	70.0

Future R.D.T. & E. efforts will be in the area of improved data link and improved day/night capability. We plan to have an improved version of the present data link ready for procurement in fiscal year 1979. We also plan to continue a program for development of an imaging infrared guidance module. Extended range data link Walleye with IIR guidance, which would be a night Walleye, is the fastest, lowest risk approach to an accurate night standoff capability available.

Mr. Chairman, that concludes my formal remarks. May I answer any questions?

MIX OF WALLEYE I'S AND II'S

Senator CANNON. Did you run out of Walleye II's for conversion?

Captain BARRINEAU. Yes; we did.

Digitized by Google

Senator CANNON. Your program planning figures show a total of about 1,400 Walleye II's and 2,400 Walleye I's. Why was that particular mixture chosen?

Captain BARRINEAU. I think it was done in part, Senator, because of the fact that the Navy inventory has been added to by residual assets that we have gotten from the Air Force.

What we have done here is we have taken over all of their residual Walleye assets and are now converting them to Navy use.

What this does is it gives the Navy the totality of the Walleye assets within the DOD while the Air Force proceeds with other weapons systems such as the GBU–15.

Senator CANNON. When would the Walleye I be the preferred weapon over the Walleye II?

Captain BARRINEAU. I think that with certain targets one might face which did not require the 2,000-pound warhead, perhaps small land vehicles, radar sites, targets that were not heavily bunkered, would be appropriate for the Walleye I.

Senator CANNON. Would the data link Walleye II be used against ships?

Captain BARRINEAU. It could be used against ships; yes, sir.

Senator CANNON. Is that in the planning?

Captain BARRINEAU. Yes, sir; it is a part of our sea control concept.

Senator CANNON. Thank you very much.

Captain BARRINEAU. Yes, sir.

General SLAY. We now have Harpoon, Captain Paul Dudley.

HARPOON PROGRAM REVIEW

Captain DUDLEY. Good morning, Mr. Chairman. I am Captain Dudley from the Naval Air Systems Command.

SYSTEM REQUIREMENTS

(SOR 11-74R-1, JUN 69, REVISED)

- SHIP/AIR/SUBMARINE LAUNCHED ANTI–SHIP MISSILE SYSTEM
- COMPATIBLE WITH EXISTING PLATFORM SYSTEMS
- ALL WEATHER CAPABLE
- TARGET PRIORITY: FIRST – MAJOR SURFACE COMBATANTS
  SECOND – PATROL CRAFT/OTHER SHIPS
- HIT PROBABILITY: DESTROYER DELETED 60 NM
  PATROL CRAFT DELETED
- LAUNCH PRIORITY: FF/P-3 / SUB / OTHER PLATFORMS

This is our overview of the Harpoon weapon system, which relates to operational requirements. As indicated, it's a high subsonic missile that would cruise at about [deleted] mach number, about [deleted]

Digitized by Google

miles an hour at [deleted] feet of altitude after acquiring a target, it descends to [deleted] feet, and accelerates to [deleted] preparatory to a terminal maneuver in which the missile climbs and then dives into the target in a [deleted] dive.

Our maximum specified range is 60 miles. We have exceeded that. Our minimum range is [deleted]. We are able to meet that minimum.

SYSTEM DESCRIPTION/CAPABILITY

- HIGH SUBSONIC, SEA SKIMMING MISSILE
- MAX RANGE – 60 NM
  MIN RANGE – DELETED NM
- ACTIVE, FREQUENCY AGILE RADAR SEEKER, LOW SUSCEPTIBILITY TO ELECTRONIC COUNTERMEASURES
- MID-COURSE GUIDANCE UNIT FOR AUTONOMOUS OPERATION
- 500 POUND BLAST WARHEAD DESIGNED FOR TARGET HULL PENETRATION
- BASIC MISSILE COMMON FOR AIR, SURFACE AND SUBSURFACE LAUNCH PLATFORMS

We have an active frequency agile radar which gives good capability against patrol boats in high seas as well as cutting down our susceptibility to jamming systems. We have a midcourse guidance system by which the missile is preprogramed and launched. In other words, it's autonomous. We do not require a data link. We have a 500-pound blast-type warhead that's designed to penetrate the hull of a ship some [deleted] feet before exploding, and thereby maximize damage.

The missile is common for the three classes of platforms, air, surface, and subsurface, merely by changing the aerodynamic surfaces, wing-fins, et cetera. We do require a rocket booster for the surface launcher.

These are the platforms the Navy plans to use. The P–3 aircraft and the A–6, approximately 300 aircraft, total; virtually all our surface combatant ships, the guided-missile destroyers and frigates, guided-missile cruisers, patrol hydrofoil, et cetera, approximately 200 surface ships will be configured; and the 3 classes of nuclear attack submarines, approximately 90 submarines.

Digitized by Google

SHIP/SUBMARINE LAUNCHED HARPOON MISSILE CONFIGURATION

DELETED

MISSILE WEIGHT	1150/1450* POUNDS
MISSILE LENGTH	151/180* INCHES
MISSILE DIAMETER	13.5 INCHES
WARHEAD WEIGHT	500 POUNDS
RANGE	60 NAUTICAL MILES

* WITH BOOSTER

This is a line drawing of the missile. The forward section, the guidance sections, contains the radar seeker, a midcourse unit, which basically is an autopilot, and our radar altimeter, the warhead section, a 500-pound warhead, and about [deleted] pounds of explosive and a delay fuze.

Finally, in the fuel tank, we use JP5 fuel, standard Navy fuel, about 15 gallons. A small turbine engine with 600 pounds of thrust, but adequate to take us to maximum range and finally, a separable booster for surface and subsurface launching.

Senator CANNON. Now, how do you fire that from shipboard?

Captain DUDLEY. From shipboard, we use the existing launcher on those ships, the ASROC launcher or the others. We also have a canister launcher.

The missile is pointed at the target if it can be done. If not, we can turn the missile up to 90 degrees off the launcher axis to proceed to the target. If it is a surface ship, it is launched at approximately a 30-degree elevation angle. In the case of the submarine, it proceeds

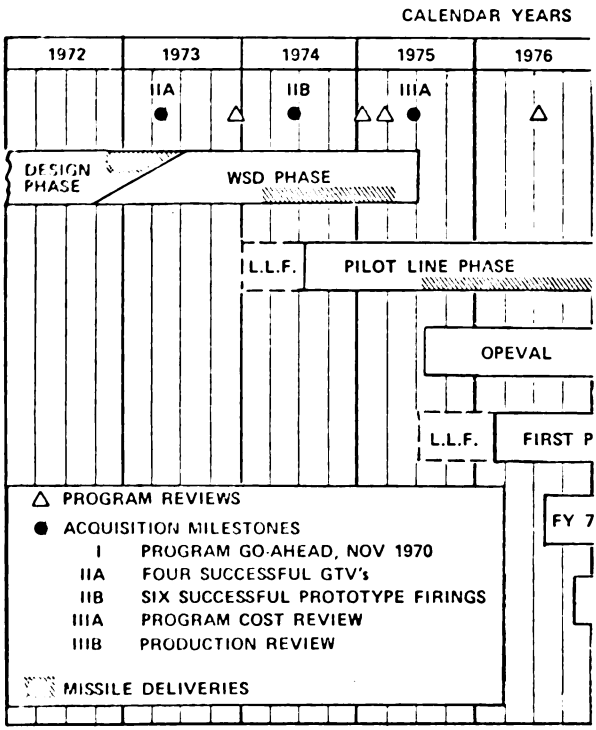
88-379 O - 77 - 10

Digitized by Google

to the surface in a buoyant capsule. At the surface, the capsule is opened, and the missile is fired. It comes out at about a 45-degree angle, and is preprogramed back down at the surface.

I have indicated the physical constraints on this system. The majority of these meet a requirement to fit existing shipboard launchers. They basically specified for us our weight, our length, and our diameter.

HARPOON PROGRAM SCHEDULE



DELETED

This is the Harpoon program. It is an extremely busy chart, but I thought it useful for the view of the development. The two phases of development are the design phase and the weapon system development phase. I have the results of the testing in that in just a moment.

We transitioned into a pilot line in the summer of 1974, when we built missiles on hard tooling, initiating the production lines. Those are the missiles that we are using in our operational evaluation.

This is our Opeval. We had hoped to complete this a year ago. We did not. We do expect to complete the firings this month, formal report next month, preparatory to the Navy systems acquisition review.

We will expect follow-on testing and evaluation of the program to go on for some period of time, as we look at other platform types and also make improvements in the system.

Digitized by Google

We are currently in our first production contracts, the fiscal year 197T and fiscal year 1977 initial production. We are holding to a rate of 10 missiles per month until completion of the operational evaluation.

The Navy does plan to accelerate these to 20 missiles per month on the last scheduled contract, by the way. Based on the results of the OPEVAL, we expect to recommend that.

I have indicated the initial operational capability for ships and submarines [deleted]. Aircraft [deleted]. That is when we will have our first aircraft requested, in the 1977 budget.

TOTAL MISSILE FIRINGS TO DATE

TEST PHASE	LAUNCH PLATFORM	NUMBER FIRED	NUMBER SUCCESSES	FAILURE DESCRIPTION
DESIGN PHASE	AIRCRAFT	7	5	1 COMPONENT, 1 DESIGN
	SHIP	4	2	2 COMPONENTS
WEAPON SYSTEM DEVELOPMENT PHASE	AIRCRAFT	16	14	1 COMPONENT, 1 DESIGN
	SHIP	16*	14	1 COMPONENT, 1 CM
	SUB	3	2	1 COMPONENT
PRODUCTION PHASE OPEVAL 10/75-2/76	AIRCRAFT	5	2	3 COMPONENTS
	SHIP	1	1	
OPEVAL 3/76-3/77	AIRCRAFT	DELETED	5	DELETED
	SHIP	DELETED	8	DELETED
	SUB	DELETED	4	DELETED
DEVELOPMENT	SHIP	1	1	

* PLUS ONE NO TEST – RANGE SAFETY
** PLUS ONE NO TEST – RANGE PROCEDURES
*** PLUS ONE NO TEST – COUNTERMEASURES

These are the test results relating to the various phases. Briefly, in the design phase, our engineering missiles, we have reasonably good success. Weapon system development, this was a contractor technical evaluation plus the Navy technical evaluation, quite good.

I have indicated the flight failures.

Of more importance right now, though, is the operational evaluation. At the time of the hearings last year, our performance was above this line. We fired five aircraft missiles, but had only two successful. We fired one ship missile and that was successful.

I reported at that time that we were in deficiency status and we had taken certain engineering actions, primarily quality-type thing and workmanship. We have been working on that for some period of time.

Since the hearings last year, or last March or really since August of last year, we have had this type of performance.

I will discuss another test in just a moment, but eight aircraft missiles were launched, and five were successful; surface ship, eight and eight; submarine, six and four. We fired one additional pilot line missile in the same manner but that was not part of the operational evalu-

Digitized by Google

ation. That missile had been deployed in the western Pacific and we wanted to get a good look at it.

In terms of the kind of problems we have had, prior to the hearings last year, we had two radar failures and one actuator failure. We instituted some fixes to take care of that. We have not seen a recurrence of the seeker problem.

More recently, we have had two component problems in the aircraft, not similar. One was a connector problem. The other was—just the other day when we lost the missile. We suspect an actuator problem, but we are not sure. It was a warhead missile.

In the case of aircraft, we have had [deleted] failure [deleted]. In the surface ships, as I said, we have had no problems. Submarine, again we had a [deleted]. In this case, we were incapable of [deleted].

We had one unknown. We had a missile fly slow, actually run out of destruct time. We postulate that it had a clogged jet inlet, but we aren't positive.

I think generally our performance has been quite good, in that part of the Opeval relating to surface ships. In the ship and aircraft portion our program has fired 22 missiles and has done so with 16 successes.

In the no test—I think this one is worth talking about—there was an [deleted], and should not have worked. However, we thought it worth going ahead and trying.

I have mentioned [deleted]. We think we have a fix for it. We have done captive airborne tests which were quite good. We expect to fire missiles next month and start proving this out. If that fix works in the missiles, we would incorporate it in the 1978 production, plus backfit in the 1977—or pick up the 1977, backfit in the remainder of our active missiles.

HARPOON INVENTORY REQUIREMENTS

- NNOR INVENTORY REQUIREMENT IS DELETED MISSILES FOR PLATFORM FILL, RESUPPLY AND PIPELINE
  - ---- THREAT BASED ON DELETED DAY NATO/WARSAW PACT WAR FOR ~ DELETED ENEMY TARGETS
  - ---- HARPOON PORTION OF IDENTIFIED THREAT IS ~ 500 ENEMY TARGETS
  - ---- HARPOON MISSILE ALLOCATION:
    - – AIR
    - – SURFACE SHIP
    - – SUBMARINE

- HARPOON BUDGET PROCUREMENT OBJECTIVE – 2451 MISSILES THROUGH FY 1982

Digitized by Google

In this Vugraph, I have indicated the basis of our inventory requirement. Our nonnuclear ordnance study requirements were [deleted] missiles, based on this scenario [deleted]. This is a pro rata share of targets for Harpoon we would allocate and we have come up with these numbers. These numbers include the requirements to fill holes, aircraft racks, et cetera, plus the recent resupply and plus the pipeline. As I say, we end up with a number of [deleted].

Our current budget is a procurement objective which currently is 2,451. We would expect the systems acquisition review council meeting to decide whether to request for this inventory requirement and how to put it in the budget, whether to put it in the outyears or try to bring it forward for a little more efficient production.

MISSILE PROCUREMENT

PROCUREMENT	FY 75	FY 76	FY 7T	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82	FY 83 + OUT
U.S. (2451)	100	170	61	245	315	390	390	390	390	–
FMS (1685)	---	145	60	192	269	139	149	205	195	331

This is an overview of the production at the 2,451 level of procurement objective, the 1978 request for 315 missiles, 1979 going to 390.

I have also indicated the foreign sales. These are not all firm letters of acceptance, but they are our best estimate of what they will be in those years.

HARPOON WPN PROGRAM BUDGET CHANGES

	FY-78			TOTAL PROCUREMENT PROGRAM		
	QTY	COST	UNIT COST	QTY	COST	UNIT COST
JUN 75 SAR	550	225.7M	410,000/UNIT	2870	1272.2M	443,000/UNIT
DEC 75 SAR	480	196.6M	410,000/UNIT	2420	1107.2M	457,000/UNIT
DEC 76 SAR	315	156.3M	496,000/UNIT	2451	1244.9M	508,000/UNIT

By way of discussing our budgets last year and this year and how they relate, let me just talk about the 1978 budget for the time being. This was our view some 20 months ago. At the time of the hearings last year, we indicated we would request 480 missiles at $196 million. Subsequently, the Navy has cut back on this, partially to live within budget guidance and with some substantial amount of recognition that the operational evaluation did not proceed as fast, and therefore, we needed a slower building rate in our production.

Digitized by Google

By reducing this, we reduced money but substantially increased our unit price. In the total program, we have cut down the number of missiles per year and added an additional year, with this effect, from this year to last.

By adding 1 more year, we increased the unit price about $50,000 a missile.

SUMMARY

- OPEVAL FIRING EXPERIENCE GREATLY IMPROVED
- FULL PRODUCTION GO AHEAD PLANNED FOR APRIL 1977
- MAJOR QUALITY/RELIABILITY EFFORT CONTINUING
- UNIT COST INCREASE DUE TO PROGRAM STRETCH

In summary of the operational evaluation firing experience is greatly improved. We do plan a full production go-ahead in [deleted] of this year. Major quality improvements we put in last summer are starting to show, as evidenced by the operational evaluation.

And finally, we have seen a unit-cost increase due to program stretch-out, approximately 1 year, with almost no increase in quality.

That concludes my remarks, Mr. Chairman. I will be glad to answer any questions.

TECHNICAL PROBLEMS WITH HARPOON

Senator CANNON. What were the reasons for the two holds in the operational testing last year, 1976?

Captain DUDLEY. The first one was at approximately this time last year and that was due to the three failures we had seen, the two radar seekers that failed to radiate and one actuator problem. The actuator problem was the test set problem in which we actually forced the failure mode in it.

But we wanted to see what our radar problems were. We recertified, fired a missile. That one worked fine. Our captive carry program—just carrying missiles around for some period of time on aircraft and ships for the reliability tests that we thought relevant, put the program back in deficiency at that point, to go in and really improve the program, we spent some 5 months this past spring and summer doing that.

We didn't identify any substantial design changes. The design changes were minor and were more in the producibility area, but we just found a lot of quality actions were required, and we are continuing to find those.

We plan to increase our acceptance test levels, the environment in which we test at each level, buildup substantially for our 1977 procurement. We are not satisfied even today with it.

Digitized by Google

Senator CANNON. Are you satisfied that you have got a handle on licking your [deleted] problem?

Captain DUDLEY. Yes, sir.

Senator CANNON. How do you solve the problem of [deleted]?

Captain DUDLEY. It would have to be by [deleted]. Intelligence may provide our [deleted] with some way that we can quantify and say, that is a bad target, and then we shoot it.

[Deleted.]

They were able to, taking all their sensor inputs [deleted]. I think we would do the same. As something like Lance comes down the road, we would certainly be able to use those.

Currently, though, out to the radar horizon, we have no such missile, but there is a need for that.

PRODUCTION PROGRAM STATUS

Senator CANNON. How far behind are you in your production through the 1977 buy?

Captain DUDLEY. In terms of our budget, how far behind?

Senator CANNON. Yes.

Captain DUDLEY. I would say the program, as a result of our operational evaluation problems, is about 6 months behind that which we had originally planned.

Now, for budget reasons, we have cut back on procurements, so we are not procuring the number we originally intended, and as I have indicated, we are not even currently in our budget procuring the inventory objective.

Senator CANNON. Well, how much of your funding that will be unused in 1977?

Captain DUDLEY. We expect to use all our funding, sir.

Senator CANNON. In 1977?

Captain DUDLEY. Yes, sir. It is currently in the contract in 1977 for our first half of the buy, but we expect after the acquisition review council to contract—next month—to contract for the remainder. We would expect to use all of our 1977 funds.

Senator CANNON. You wouldn't have any funds that could carry over against the 1978 budget?

Captain DUDLEY. No, sir.

Mr. CROMWELL. Captain, isn't it correct that the Navy has attempted to reprogram money out of the Harpoon program in fiscal 1977?

Captain DUDLEY. Yes, sir. What I showed was that which is my Harpoon budget currently. If you go back to last year, what Congress appropriated, there was more money than that appropriated; yes, sir.

Mr. CROMWELL. Well, wasn't your answer a little misleading, then?

Captain DUDLEY. Not from my standpoint. No, sir.

Mr. CROMWELL. Well, I think it was from the committee's standpoint because the Navy is not going to use all the money that the Congress appropriated for Harpoon last year, and they have attempted to reprogram money out of Harpoon into other projects. This committee has turned the reprogramings down and has sent a letter saying that the money will be applied to fiscal 1978.

Captain DUDLEY. I was not aware of that, sir.

Digitized by Google

Mr. CROMWELL. You may not be aware of those, but you certainly were aware of the fact that some of your funds were going to be reprogramed away from you.

Captain DUDLEY. Yes, sir; I was aware of that.

Mr. CROMWELL. Would you supply for the record how much money is available for carry forward to 1978?

Captain DUDLEY. Yes, sir.

Mr. CROMWELL. I also want that to cover fiscal 1976 and 197T, if there is any excess in those fiscal periods.

Captain DUDLEY. Sir, I will supply that for the record.

[The information follows:]

In fiscal year 1976, $4.9 million is not required for completion of the 1970 missiles under contract and has been requested for transfer to the fiscal year 1976 CAPTOR Program.

The CAPTOR Program requires a total of $+6.7 million fiscal year 1976 funds to fully finance production support through fiscal year 1976 deliveries and Harpoon constitutes the Navy's major fiscal year 1976 asset for that purpose.

Congress initially appropriated $142.8 million for the 270 missile Harpoon Program which had subsequently been reduced by $11.3 million. An approved fiscal year 1976 DD–1415 reprograming action transferred $6.0 million to the Sidewinder missile, reflecting a decision to implement a cost reduction program and delete 91 Harpoon surveillance missiles. In addition, $5.3 million was reprogramed within the Navy's authority: $1.9 million for Harpoon modifications; $2.2 million to Shrike missile procurement and $1.2 million to satify various cost increases.

In fiscal year 197T, $42.3 million was appropriated and the current program is $43.0 million, a net increase of $.7 million. No fiscal year 197T funds are available for reprograming.

In fiscal year 1977, the Congress appropriated $178.3 million for 350 Harpoon missiles; however, $16.8 million of these funds was subsequently utilized by the Navy to satisfy a general reduction levied against the WPN appropriation by the Congress.

The Navy is currently proposing to reprogram $17.0 million procurement plus $1.0 million Harpoon Spare and Repair Parts funding to solve a critical problem with respect to the Standard MR missile. The Harpoon asset plus various other resources are required to alleviate a shortage of Standard MR missiles and avoid a costly, both in terms of reliability and funding, production line break.

The Navy has no other available fiscal year 1977 funding assets to meet this requirement and failure to approve the reprograming action would seriously impair the Standard MR missile program.

In summary, a total of $22.9 million fiscal year 1976–77 Harpoon funds is currently reflected on DD–1415 reprograming actions under Congressional consideration for utilization in the Captor and Standard MR Programs.

PRODUCTION PROBLEMS WITH HARPOON

Mr. CROMWELL. How much of this missile does McDonnell Douglas actually make in their plant? They are the prime and they assemble it, but how much do they actually make?

Captain DUDLEY. They actually make the shell that contains the guidance section, the fuel tank, the shell that contains the actuators, virtually the whole outside skin. The fuel tank is a fairly massive structure itself.

In terms of electronics, they actually make the servo drive assemblies which translate the midcourse guidance unit responses back to the actuators.

Digitized by Google

Mr. CROMWELL. In dollar terms, what does that amount to?

Captain DUDLEY. In dollar terms, looking at the total program, at the cost level—they make about 40 to 45 percent.

Mr. CROMWELL. Have you had problems with the missile test set? Would you describe those?

Captain DUDLEY. Yes; the missile test set is a large and very sophisticated piece of equipment. We did, in the process of inventing the missile, on a fairly crash basis, not have time to get the test set in our development phase. So we started off and we had to make a decision, as we went into the operational evaluation, whether to continue on manual equipment for that period or try to make the automatic test set work.

We elected to make the automatic test set work. We have had a number of problems with it, in terms of getting our tolerances down so that we can pass through the missiles. We have had reliability problems. I think we are getting on those pretty well. Such mundane things as connectors were problems. Consequently, our yield was extremely poor in terms of tests. Second, we didn't know whether we had a good missile or bad.

We have always felt and are sure today that if the test set gave us a go, we had a good missile. If it said the missile was bad, we weren't positive, and it required additional tests.

Mr. CROMWELL. What is the current status of that test set?

Captain DUDLEY. In the current test set, sir, we would expect that 9 out of 10 times we run it, given that it is operational, that we would get a good reading on the missile. Either it would say the missile was good and it was good, or it would say the missile was bad and indeed, the missile has failed.

Mr. CROMWELL. Does it ever say a missile is good when it is bad?

Captain DUDLEY. Not that we can document. We don't think that is the case at all.

Mr. CROMWELL. Thank you.

Captain DUDLEY. Yes, sir.

OVERALL STATUS OF AIR-GROUND WEAPONS

Senator CANNON. Looking at the overall status, Admiral, of the air-to-ground ordnance program, the Navy's Condor missile was canceled by the Appropriations Committee last year, leaving a gap in the air-to-ground spectrum in the powered, standoff, 50–100 mile range capability. Does the Navy feel they still have a requirement for a Condor or similar capability?

Admiral MANDEVILLE. Yes, sir, we do.

Senator CANNON. Did the Navy request funding in 1978 to restart the Condor procurement, and if so, what happened to the request?

Admiral MANDEVILLE. I would say the Department of Defense did not resubmit the startup program. We did discuss this candidly with the Department of Defense and thought that it was probably not the proper thing to do.

Digitized by Google

Senator CANNON. In other words, you didn't actually submit it. You just discussed it with them.

Admiral MANDEVILLE. Yes, sir. It was never part of the budget submitted.

Senator CANNON. General Slay, do you envision a need for some kind of weapon similar to that; that is, a standoff weapon with the general characteristics of the Condor, or something on that order?

General SLAY. Yes, sir, we do. As a matter of fact, we are currently participating in a joint study with the Navy, a standoff missile study. We have had several interests, including Condor, Walleye, GBU-15, plus other concepts for standoffs. Of the weapons that have been looked at that are either in the inventory or were at the time that the study was run, both the Navy and the Air Force agreed that the GBU-15 and Condor were the two most cost-effective, assuming good weather. Assuming bad weather, an attack against ship targets from standoff, of course, the Harpoon was judged to be most cost-effective.

The GBU-15 is, I think, a very good weapon, a relatively cheap weapon. Of course, it has disadvantages that are quite apparent. Any missile that is not powered has disadvantages. You can't shape its trajectory and you are limited on launches from low levels, as far as standoff range is concerned.

But, yes, sir, to answer your question very directly, the Air Force does have a requirement for a standoff weapon, relatively long range, with a secure data link.

Senator CANNON. Does this study indicate that you will probably be getting together and coming to Congress with something to fill this gap?

General SLAY. Absolutely. We have crossed that bridge long since. We are not coming back to Congress with something of that magnitude unless we are together.

Senator CANNON. When do you expect that we would probably hear from you on that?

General SLAY. Probably before the next session, sir. I would hate to make it any more definite than that. We have a lot of traps to run yet.

You might want to answer that?

Admiral MANDEVILLE. I concur with that.

Senator CANNON. OK, thank you.

General SLAY. Sir, we have Capt. Ed Barrineau back up again for the HARM program. He is backed up by Lt. Col. Bob Slater of the Air Force, who is deputy program director.

HARM PROGRAM REVIEW

Captain BARRINEAU. Mr. Chairman, if I may present the HARM program, which is a part of the defense suppression systems project.

Contained within the defense suppression systems project are the antiradiation missiles which we jointly manage with the Air Force, with the Navy acting as the executive service. Today, I will discuss the

Digitized by Google

HARM and then we will have the Air Force discuss the Shrike following this presentation.

I am doing that because the Navy procurement in Shrike has now been completed. The Air Force is continuing, however, with the Shrike–9 and the Shrike–10.

The mission of antiradiation missiles, or HARM's, is to suppress or destroy land- and sea-based radiating electromagnetic targets. Our early usage of arms was centered almost entirely on suppressing those radiofrequency emitters associated with surface-to-air missiles.

The suppression of surface-to-air missiles still remains a prime part of the ARM mission, but we also recognize the usage of ARM's to suppress any emitter if it is tactically desirable to do so. ARM's perform their suppression or destruction mission by passively homing on the radio frequency emissions of threat targets.

The antiradiation missiles requirement is driven by the proliferation of emitters associated with threat systems both land and sea-based. This chart shows the emitters associated with surface-to-air missiles and air-defense artillery. The radio frequencies of these emitters are shown at the bottom of this chart while at the top is shown those frequency bands covered by the current Shrike and standard ARM.

At the extreme top of the chart is shown the frequency coverage of the baseline HARM missile. As you will note, it encompasses in a single seeker a coverage that considerably exceeds that of either Shrike or standard ARM. The dashed lines on either side indicate the potential for additional frequency growth.

This chart shows the population of emitters associated with surface-to-air threat systems and comprises a partial basis for the inventory objectives for HARM for the Navy and the Air Force. This overlay indicates the coverage of this population by the HARM missile.

Some emitters [deleted] within the HARM seeker band but the frequency coverage of HARM has been selected to optimize the available technology and package it in a single seeker head.

HARM can be utilized to suppress or destroy emitters other than those associated with surface-to-air systems and this immediately opens up a very large population of potential targets as shown here. These current numbers which have been compiled for all Communist bloc countries include early warning radars, air traffic control radars, and weather radars whose destruction or suppression would pay tactical dividends.

In fulfilling the HARM requirement, we are developing an integrated missile system. The HARM missile which is a part of this system is shown here. The missile seeker, control section and wings and fins are being developed for us by the Texas Instruments Corp. The warhead rocket motor and fuzing are being developed by other contractors under the supervision of the Naval Weapons Center, China Lake.

Missile seeker coverage is contained in a single seeker head utilizing a fixed antenna. This means that we have eliminated the expensive and

Digitized by Google

complicated gimbaled system associated with most air-launched missiles.

We have also eliminated all pneumatic and hydraulic systems and have developed a simple and inexpensive autopilot. The high-speed rocket motor, which is also smokeless, is being developed for us by the Thiokol Corp. in Utah, while the optical target detector, which is a part of the fuzing system, is under development by the Motorola Corp. of Scottsdale, Ariz.

The other major part of the HARM weapon system consists of the avionics and the cockpit control panel shown here for the Navy A–7 aircraft. The Air Force utilizes the avionics and displays contained in its Wild Weasel system to interface with the HARM.

The command launch computer interfaces with the existing radar warning system and other onboard avionics, while the cockpit control panel consists of simply modifying an existing panel.

What we did, Mr. Chairman is, we took the radar warning receiver panel, which is already in the aircraft and we just integrated it into the ARM function.

The command launch computer contains a memory sufficient to include the totality of land- and sea-based emitters that our Navy task forces may encounter. The Air Force possesses a similar capability with its Wild Weasel system.

In developing the HARM system, we are providing three basic modes of operation for the tactical air crew. The most fundamental operating mode is the self-protect mode which uses the [deleted] degree coverage of the radar warning receiver to detect threatening emitters.

The HARM command launch computer then sorts and prioritizes these emissions and provides in digital language a complete set of instructions for the missile. It does this within less than [deleted] and the pilot can fire the HARM almost immediately.

Senator CANNON. Does the computer scan the entire emitting spectrum to come up with the proper frequency?

Captain BARRINEAU. The way we do this in the self-protect mode, Senator, is, we are receiving the total input from the onboard radar warning receiver. We pass this through a video processor which is contained within the command launch computer, which we have preprogramed and prioritized before we ever put it in the aircraft, and it simply sorts through all the signals available to it and assigns the priorities.

The target of opportunity mode utilizes the very high sensitivity of the missile seeker to detect the [deleted] of radars and also those transmissions associated with the [deleted]. This permits the suppression or destruction of targets by homing on emissions that could not be detected and handled by Shrike or stanadard ARM.

Through flexible software, the missile can be instructed prior to launch to home on a series of [deleted]. What this means is that we are

Digitized by Google

no longer bound by hard wired technology and have solved a part of the [deleted] problem.

The final operating mode, which is the prebriefed mode shown at the upper left, utilizes the long range of the HARM to fire against targets whose signals can be detected but are [deleted] or can be used to fire the HARM on a precomputed trajectory into the vicinity of known targets. If these targets emit while the HARM is in flight, they are attacked immediately.

Of course, if the target does not come up, then the HARM [deleted].

BASIC CAPABILITIES SUMMARY

- BROAD FREQUENCY COVERAGE. BASELINE DELETED EXPANDED VERSION DELETED
- IN-FLIGHT RETARGETING
- FLEXIBLE THREAT EMITTER FILE
- MINIMAL NEW AIRCRAFT EQUIPMENT
- 70 HOURS MEAN TIME BETWEEN FAILURE
- LARGE AREA COVERAGE WITH HIGH-SPEED, SMOKELESS MOTOR
- ADAPTABLE TO SEVERAL PLATFORMS

In summary, then, these are the basic capabilities of the HARM and they include broad frequency coverage [deleted] flexibility, reliability, large footprint and adaptability to different types of aircraft with minimal investments in new equipment.

Digitized by Google

ACCOMPLISHMENTS SINCE LAST YEAR

- TWO GUIDED MISSILES SUCCESSFULLY FIRED INCLUDING FIRST GUIDED FIRING WITH HIGH SPEED MOTOR. ALL GUIDANCE MODES DEMONSTRATED.
- THREE FLIGHT TEST VEHICLES FIRED. AERODYNAMIC PERFORMANCE VALIDATED
- SUPERSONIC CARRIAGE TO MACH 1.3 DEMONSTRATED
- AIRCRAFT/MISSILE SOFTWARE INTERFACE DEMONSTRATED AND REACTION TIMES VALIDATED
- SMOKELESS MOTOR DEMONSTRATED
- OPTICAL FUZING EXCELLENT

Since our appearance before your committee last year, Mr. Chairman, we have accomplished a number of advancements in the program. Although the delivery of hardware has been delayed as we reported to you, we have been able to undertake a firing program of new design hardware and this has been successful as depicted in this chart.

We have been pleased and encouraged by both the aerodynamic and electronic performance of the system. A number of risk areas have been eliminated in the process. We are especially encouraged by the fine smokeless performance of the rocket motor, the successful interfacing of the aircraft and missile software systems and the performance of the missile during high-speed carriage.

These pictures show the firing of the first fully guided HARM while mated to the new high-speed, smokeless rocket motor. We did this firing in November, as our final firing for DSARC. The firing was a success with a near-direct hit at a miss distance of [deleted].

This picture shows the firing of a HARM guided missile utilizing a Shrike rocket motor prior to the completion of man-rating of the HARM motor. That is on your left. Now, the firing that is on your right was the firing we did in November. This was our first opportunity to match up with the seeker and a new rocket motor, and this gives you some feel for the smokelessness of the system. The smokelessness of the HARM motor virtually nullifies the presence of smoke with which a ground observer could identify this launch. [Deleted.]

The remaining test objectives which we expect to accomplish with the fiscal year 1977 funds which you authorized last year is shown on

Digitized by Google

this chart. Some of these objectives are significant in that our firing against a [deleted] emitter will mark the first time that this has been accomplished with an antiradiation missile.

A demonstration of adequate performance against [deleted] frequency emitters will be significant because of our virtually nonexistent coverage in these [deleted]. What I am saying here, Mr. Chairman, is, we have essentially no coverage below [deleted]. We have a little bit of coverage with the Navy Shrike [deleted] missile, but we are especially interested in seeing that we get [deleted] into the HARM. Our planned firing is against a target operating at [deleted].

The R.D.T. & E. requirements for both the Navy and Air Force with our fiscal year 1978 request is shown here. The total R.D.T. & E. requirement exceeds that which was provided to you last year.

The increase reflects some slippage at the contractor's plant which we reported to you and also reflects a realistic adjustment of the program to more adequately permit necessary development and testing prior to committing to production. The expected required funding is not out of line with what we have experienced in other programs and quite candidly, our earlier expectations were simply too optimistic to be attained.

HARM

STATUS OF FUNDS

(MILLIONS OF THEN YEAR DOLLARS)

MARCH 1977

	FY TQ & PRIOR	FY 77	FY 78	FY 79	FY 80-82	OUTYEARS BEYOND FYDP	TOTAL
RDT&E							
64360 N*	64.0	30.0	29.7	34.5	27.4	–	185.6
27162 F		.5	2.3	1.3	2.0	–	6.1
PROCUREMENT							
NAVY				43.5	357.8	326.6	727.9
(QUANTITY)	–	–	–	(80)	(2700)	(3233)	(6013)
AIR FORCE					199.9	110.1	310.0
(QUANTITY)	–	–	–	–	(1750)	DELETED	DELETED

*PRIOR TO FY 77 FUNDED UNDER PE 63363N

Primary funding for the program is, of course, provided by the Navy as the executive service. The small amount requested by the Air Force is to fund only their unique requirements to support their opertional concepts which in some areas must differ from those of the Navy.

We do not require procurement funding in fiscal year 1978 as indicated to you in our testimony last year. This requirement has now moved to fiscal year 1979 as a result of the more realistic realinement mentioned earlier. The inventory requirements have also changed and

Digitized by Google

reflected here are the latest objectives for both the Navy and the Air Force. The procurement funds which we will require in later years ago reflect the cost of developing a second competitive source for procurement.

The schedule for the baseline HARM program as adjusted, is shown at the top of this chart. The second schedule below that is a possible schedule which we may be required to pursue in response to a recent DSARC decision which I will discuss in a moment. This extended schedule, if implemented, reflects DSARC direction to retain the HARM in advanced development while undertaking an additional effort to expand HARM frequency coverage from [deleted] gigahertz [deleted] gigahertz. The incremental cost to accomplish this additional effort are under study and are not included in the President's budget, which was submitted earlier to you.

FY-78 FUNDING REQUIREMENTS

- **CONTINUE WITH ENGINEERING DEVELOPMENT**
  - FABRICATE AND ASSEMBLE 18 GUIDED MISSILES
  - FABRICATE AND ASSEMBLE SIX AVIONICS SYSTEMS
  - PROCURE ENGINEERING UNITS OF ROCKET MOTORS, WARHEADS, FUZES AND LAUNCHERS
  - DEVELOP AND PROCURE LIMITED SUPPORT EQUIPMENT
  - CONTINUE TESTS AT SYSTEM AND SUB-SYSTEM LEVEL
- **CONTINUE PROCUREMENT OF COMPETITIVE DATA PACKAGE**
- **CONTINUE RELIABILITY, MAINTAINABILITY AND SUPPORT PLANNING**
- **VALIDATE PRODUCTION ENGINEERING AND TESTING**

Although some funding requirements may move downstream, we do not expect our fiscal year 1978 funding requirement to change. Specifically, those efforts which we would expect to complete with the funding which we are requesting are shown on this chart.

We must continue with our basic engineering and development of the HARM, including the support we require from several contractors and our in-house Navy team. We would also expect to continue with our development and procurement of a data package suitable for competition as soon as the system enters the procurement phase.

Our efforts and planning to insure reliability, maintainability and adequate support must necessarily go forward, as must our planning for downstream production.

Digitized by Google

SUMMARY

- STRONG REQUIREMENT
- INNOVATIVE CONCEPT
- PROVIDES A CAPABILITY THAT IS
  - FLEXIBLE
  - PRODUCIBLE
  - COST-EFFECTIVE
- PROGRAM RESTRUCTURED
- NO MAJOR TECHNICAL PROBLEMS

I would summarize by noting the strong requirement for the HARM, the highly flexible capability that it will provide to our tactical forces and would further note the good technical success that we have had and are continuing to have in the program.

I have purposely kept the presentation short, Mr. Chairman, so this concludes my remarks. Are there any questions?

88-370 O - 77 - 11

Digitized by Google

COSTS OF HARM

Senator CANNON. What is the estimated per unit cost now, without this expanded capability program?

Captain BARRINEAU. Without the expanded program, the Navy's estimated unit procurement cost—unit hardware cost, in fiscal year 1976 dollars is $61,000 per unit.

Senator CANNON. Is that the program unit cost, or is that just a——

Captain BARRINEAU. No, sir, that is the hardware cost. This is the basic hardware now, before you amortize tooling and engineering support for production.

The program unit cost is $119,000 per unit over the life of the program.

Senator CANNON. Do you have any estimates on the expanded capability program, as to what that is likely to run?

Captain BARRINEAU. Senator, we have two estimates. We looked at the notion of expanding the HARM prior to going to DSARC in January. At that point, our contractor indicated that he could implement it—I am speaking now of the cost, the procurement cost of implementing it—that he could implement it with one level of sensitivity for an increase of about $10,000 per missile or he could make it more sensitive down to around [deleted] DBM and this would lead to a per unit cost increase of about $20,000 per missile.

We are currently examining, however, another proposal from him, wherein he has changed his technical approach and he would expect to give us a system with modest sensitivity for an incremental cost of $5,000 per unit; or he could increase the sensitivity for about $10,000.

Senator CANNON. Who is your contractor?

Captain BARRINEAU. The contract for this prime contract was issued out of the Naval Air System Command.

Senator CANNON. But who is the contractor?

Captain BARRINEAU. Oh, this is Texas Instruments.

Senator CANNON. Is the contractor having some technical and cost difficulties?

Captain BARRINEAU. Well, he has had some increase in cost. Now, when I was over last year, I reported to you that he was reporting to me roughly $6.6 million overrun in the initial phase. This is a contract with options for a three-phase program, I might add. There have been some initial costs and he is presently estimating a cost overrun of about $10.5 million for his current phase, which is now coming to an end.

The original target on that was for $19.3 million.

Senator CANNON. Are you saying his original contract was $19 million and he is going to be $10 million over?

Captain BARRINEAU. I am saying that for this initial phase which is the advanced development phase, we had a target of $19.3 million, and he is going to exceed that by at least $10.5 million.

BASIC DESIGN OF HARM

Senator CANNON. Who designed this missile? Did the Navy design this?

Captain BARRINEAU. The genesis of the HARM goes back several years, Mr. Chairman. It goes back to the very late 1960's, or early

Digitized by Google

1970's, at the Naval Weapons Center at China Lake and we had an advanced development program there. We had not developed at that point all of the avionics nor the high-speed rocket, but we did have an advanced development program, utilizing some exploratory hardware and some pieces of hardware which had been adapted from Shrike.

We had a successful firing program. We had three guided HARM's. Two out of three were direct hits. And we had a number of preprogramed flight test vehicles.

It is from that technology base that the current HARM is being developed.

POSSIBLE COMPETITION IN R. & D.

Senator CANNON. You referred to a possibility of going to a second source. What is the reason for that?

Captain BARRINEAU. We have always had in our planning a second source, once we go into production, and this is what I was alluding to earlier when I said that we were paying for the procurement of a complete data package so that we could use it in order to introduce competition.

Our plans have been to introduce competition after the Department of Defense authorized the system for full-scale production.

Senator CANNON. Is this going to drive your unit cost up, if you go to a second source?

Captain BARRINEAU. No, sir, we expect to bring the unit cost down. But I do need to add—and I refer to this in my script here—that we have to amortize the cost of bringing the second competitor on board. We have to carry him through a qualification phase. We have to tool him and pay him to produce his first articles.

Senator CANNON. Are you also going to get a second source into the design program?

Captain BARRINEAU. We have been asked, by the Secretary of Defense to look at the possibility of trying to bring aboard a second source as a part of engineering development. We have looked at this in recent weeks and it appears that in order for us to do this, according to Navy counsel, that we would have to again go through the source selection process; and it appears to me that if we do it, that is going to take quite some period of time in order to accomplish.

Specifically, the OSD direction to us was to see if we could bring on board some additional contractors to do some design studies and submit firm proposals. That would require formal competition and would probably take up to a year and a half for us to accomplish.

If we wanted to compete in the sense that we wanted a second contractor to build hardware and have a runoff between it and the current hardware at Texas Instruments, then I would expect it would take us 3½ to 4 years in order to go through this entire competitive process and bring a contractor on line and let him build hardware.

EXPANDED CAPABILITY AREA

Senator CANNON. What was the upper limit of the area you didn't have coverage? Was it [deleted].

Captain BARRINEAU. Yes, sir, that is correct.

Senator CANNON. What is the threat in that range?

Digitized by Google

Captain BARRINEAU. Would you put up the threat chart?

We have specifically [deleted] threats in the area, Senator. We have the [deleted] and the [deleted] the [deleted] is a [deleted] system. The [deleted] is [deleted] as a [deleted] system.

We cannot fully cover these systems with the HARM. We can, however, cover their target [deleted] within the HARM frequency coverage [deleted]. But we cannot cover their [deleted].

Now, the other system that is not covered is the [deleted] and we are unable to cover its [deleted].

Senator CANNON. Is that [deleted]?

Captain BARRINEAU. Yes, sir, it is.

We feel, however, that the antiradiation missile is not the only weapon that we can bring to bear against that particular target.

Senator CANNON. That would be a pretty expensive weapon to use against a [deleted].

Captain BARRINEAU. There are certainly some cost-effective considerations.

Senator CANNON. All right. Thank you.

General SLAY. Yes, sir.

We now have Lt. Col. Curtis James on the ABM–45, Shrike.

Of course, I am sure the chairman knows that we have Wild Weasel coming along, with our first squadron operational in April of 1979, and when they talk about slipping HARM, it makes us nervous.

SHRIKE PROGRAM REVIEW

Colonel JAMES. This briefing will provide an explanation of the Shrike objective requirement, a description of the system's capabilities, inventory objectives and we will cover the other items, as are shown.

SHRIKE PROGRAM

REQUIREMENT:

FOR EMPLOYMENT AGAINST ENEMY GROUND BASED RADARS

SURFACE-TO-AIR MISSILE SITES (SAMS)
GROUND CONTROL INTERCEPT (GCI)
FIRE CONTROL AND EARLY WARNING RADARS

EMPLOYMENT A/C

F-105D/F/G
F-4C/D/E/G

We have been procuring Shrikes since 1965, to counter the enemy's air defense system and its radar-guided weapons, as shown. We employ the Shrike primarily on the Wild Weasel. However, they have been employed on non-Wild Weasel aircraft used as wingmen.

Digitized by Google

AGM 45 SHRIKE CHARACTERISTICS

OPERATIONAL	
RANGE	[redacted]
SPEED (AVG, 10NM)	
ACCURACY	
TECHNICAL	
LENGTH	10 FT
DIAMETER	8 IN
WEIGHT	400 LB
WARHEAD	145 LB, HE-FRAG
FREQUENCY (-9 AND -10)	[redacted]

Here are some of the Shrike's technical and operational characteristics. A unique feature of the Shrike–9 and Shrike–10 is the frequency coverage shown in the bottom line. Those two heads will cover more frequencies than all of the six previous Shrike missiles.

This is the buildup of the group 1 inventory, along with the fiscal year 1982 objective. Now, the group 1 is simply the Shrike–9 and Shrike–10. They are the preferred missiles. However, we still have the older group 2 in the inventory. They do have frequency limitations. They don't cover some of the new radars.

Principal among these—they don't cover all the radars [deleted]. They don't cover the [deleted] that Captain Barrineau just mentioned [deleted] and a very important [deleted]. [Deleted.] So they are not a preferred weapon; however, they still are usable. They do reduce your opportunity to fire.

Senator CANNON. How rapidly are you using up that inventory?

Colonel JAMES. Currently, not at all, sir.

Senator CANNON. You are not using any for training?

Colonel JAMES. Not currently, sir. There are some plans in the early stages right now at Tactical Air Command to reinstitute Shrike training. We used to do that and cut it off 3 years ago.

AGM 45 PROGRAM STATUS

AGM 45 - 7A NTE/IOT&E TERMINATED	MAY 76
NOT RECOMMENDED FOR PRODUCTION	
AGM 45 - 10 NTE/IOT&E COMPLETED	APRIL 76
RECOMMENDED FOR LIMITED PRODUCTION	
WRM REQUIREMENTS CHANGED	JULY 76
GRAVITY BIAS / PRESSURE RATE ECP APPROVED	JULY 76

Digitized by Google

During 1976, sir, the 7A I.O.T. & E. was terminated. It was not recommended for production. It had antenna problems, in polarization that caused it to have difficulty homing in on the [deleted] signal. which was one of its primary targets. It also had an excessive sensitivity to targets behind it, and it was not recommended for production.

The Shrike–10 test firing results were good and the missile was recommended for a limited production of 150 units until the production run has been verified and a competitive data package is developed.

The WRM requirements changed this year, and this changes the number and mix of Shrikes required to counter the air defense system.

During the I.O.T. & E. of the Shrike–9, several of the impacts were short of the targets. [Deleted.]

The Naval weapons center proposed an ECP, an engineering change proposal, to provide a gravity bias in the Shrike, and this will cause it to tend to fly over the target and thereby giving you higher lethality.

It will also, because of the change in pressure, of the point where the pressure ports are located, gives you a pressure rate capability and gives you a better employment envelope.

AGM 45 PROCUREMENT FUNDING/QUANTITIES

	FY 77 & PRIOR	FY 78	FY 79	TO COMP	TOTAL THROUGH FYDP
FY 77 BUDGET					
FUNDING ($M)	280.3	50.9		CONT	492.8
QUANTITIES	12818	1300			17888
FY 78 BUDGET					
FUNDING ($M)	280.3	40.9	51.1	CONT	559.1
QUANTITIES	12533	900	1160		18488

Here is the budget track from the 1977 and 1978 budget and changes caused by the items shown in the previous slide. The 1978 budget request calls for $40.9 million.

NAVY FY 78 SHRIKE BUDGET

	FY 77	FY 78	FY 79
FUNDING ($M)	1.2	1.0	1.1

Digitized by Google

Sir, the Navy budget request for Shrike reflects simply the requirement for fleet support, modifications and for spares for the current inventory.

AGM 45 SHRIKE SUMMARY
GROUP I MISSILES

- FY 82 INVENTORY REQUIREMENT
- FY 82 PROJECTED INVENTORY
- INVENTORY SHORTFALL
- NEEDED TO COUNTER RADAR THREAT

In summary, sir, here again is the inventory requirement, along with the projected inventory at the end of fiscal year 1982, showing the large shortfall. Since the threat is such a serious one and of such numbers, you can see that the continued procurement of Shrike is needed.

HARM VERSUS SHRIKE

Senator CANNON. Does the HARM fit into this picture at all?

Colonel JAMES. Sir, the HARM is an additional missile, has much higher capability, greater capability than Shrike. It doesn't replace Shrike, but it supplants it quite a bit.

Senator CANNON. What is your unit cost now?

Colonel JAMES. The two missiles vary by $8,000 each. The Shrike–9 would be more expensive than the Shrike–10 because of one electronic component. But the average price is about $45,000, in this year's procurement.

Senator CANNON. Does the Navy have any plans to use the Shrike–9 and Shrike–10?

Admiral MANDEVILLE. Not at the present time, but it depends on what is the result of our work with this DSARC decision. If we do get slipped 3 or 4 years in our HARM procurement, we will have to go to something else.

Senator CANNON. Would it be logical for you to go to this?

Admiral MANDEVILLE. Yes, sir. I guess that is probably the first fallback we would have.

Senator CANNON. Can this be used in the Wild Weasel, General Slay?

General SLAY. It will be, sir. It is not our first-class weapon. As you know, in Southeast Asia, we only had [deleted] for every Shrike we fired. It caused them to pull the plug, and that was the real object—to suppress them. But we didn't kill much, and I doubt that [deleted], to tell you the truth. I would say [deleted] was more like it.

Digitized by Google

But these new Shrikes are supposed to be much better weapons, but we haven't fired those in anger yet.

Colonel JAMES. They do have capability, sir, that the early Shrikes did not.

LIMITATIONS ON SHRIKE

Senator CANNON. The Shrikes have had a lot of problems. What are they?

General SLAY. Sir, a couple of things. [Deleted.]

The standard ARM does have [deleted] but with the small warheads these things have—and they are pellet-type warheads—you have to be pretty doggone close.

And even on the one kill that I am sure we got with photographic evidence with the standard ARM—at least on the Air Force side—we knocked the sail off of a Barlock radar. About 2 weeks later, that Barlock was turning again.

So it keeps them down. It keeps their heads down, which is extremely valuable. I don't want to talk down the [deleted] because that kept their PK on our fighters from being much higher than it was, and that is the real value. If they must pull the plug, they can't eliminate us.

But yes, sir, we can use Shrike and do intend to use Shrikes on the Wild Weasel, but we sure want the HARM, and it just hurts me to think of a 3- or 4-year slip in the project.

Senator CANNON. I understand we have the R. & D. summary now. I wonder if we could put that in the record. I have a little time problem.

General SLAY. Very good, sir. We would be happy to, sir.

Senator CANNON. Please put that in the record.

[The prepared statement of Capt. Charles R. Bowling, USN, and Col. George W. Acre, U.S. Air Force, follows:]

FY-1978 TACTICAL AIR POWER HEARINGS
R&D SUMMARY
AIR FORCE AND NAVY AIR-TO-SURFACE ARMAMENT

Briefers: CAPT CHARLES R. BOWLING
UNITED STATES NAVY

COLONEL GEORGE W. ACREE
UNITED STATES AIR FORCE

Mr. Chairman, it is our privilege to discuss the Air Force and Navy air-to-surface research and development projects which are included in the fiscal year 1978 budget request. I am Captain Bowling and will present the navy projects. With me is Col. George Acree who will discuss the Air Force programs.

Digitized by Google

AIR FORCE/NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT OVERVIEW

- 22 PROGRAMS
- ADVANCED DEVELOPMENT (6.3) PROGRAMS
  - 4 AIR FORCE
  - 6 NAVY
- ENGINEERING DEVELOPMENT (6.4) PROGRAMS
  - 7 AIR FORCE
  - 3 NAVY
- WEAPON MODIFICATION
  - 1 AIR FORCE
  - 1 NAVY
- 42 PROJECTS
  - 16 ADVANCED DEVELOPMENT
  - 26 ENGINEERING DEVELOPMENT

The air-to-surface development efforts include 22 programs of which 10 each are in advanced and engineering development. Also included in this presentation are two important weapon or weapon system modification programs. The distribution of these programs among the services are shown on this viewgraph. Within these programs are 42 projects which comprise the Air Force and Navy technology and development efforts to provide a sound base for future air strike munitions. I will now discuss the Navy projects.

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROGRAMS

PROGRAM ELEMENT	PROGRAM TITLE	FY-78 FUNDING
63202N	LASER GYRO	3.1
63303N	ERASE TECHNOLOGY	1.7
63306N	AIR-TO-SURFACE MISSILE TECHNOLOGY	3.7
63313N	LASER MAVERICK	2.6
63369N	AIR-TO-GROUND STANDOFF WEAPON	1.1
63514N	AIRCRAFT AND ORDNANCE SAFETY	1.0
64360N	HARM	29.7
64603N	UNGUIDED CONVENTIONAL AIR-LAUNCHED WEAPONS	8.7
64604N	CHEMICAL WARFARE WEAPONS	2.2
25645N	MODULAR GLIDE WEAPON IMPROVEMENT	2.1
		55.9

Digitized by Google

As may be seen in this viewgraph, the Navy is supporting ten developmental programs at a cost of $55.9 milion. This compares with last year's presentation of seven programs at $56.5 million. I might point out that in last year's presentation, the weapon modification or improvement program was not included. Within these programs are several specific projects which I will describe in detail. Those programs highlighted in the viewgraph have been previously presented and will be discussed further.

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63202N	LASER GYRO	• DEVELOP LOW COST LASER GYRO INSTRUMENTS AND SYSTEMS	3.1

Explanatory development efforts have indicated the feasibility of using laser technology in providing inertial guidance for missiles and navigation systems. The potential exists for development of a low cost, highly reliable virtually maintenance-free gyro system as compared to those currently used. Laser gyros will have broad application in aircraft navigation systems as well as missile guidance and control. The use of laser gyros in missile application is particularly attractive because of the light weight, small size, low cost, reliability and the ability of the gyro to achieve almost immediate stability. During fiscal year 1978, the Navy, as lead service in this joint development effort, will continue cost reduction and reliability development in addition to commencement of test and evaluation of the system.

NAVY AIR - TO- SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63303N	ERASE TECHNOLOGY	• PROVIDE DEFENSE SUPPRESSION TECHNOLOGY NOT IDENTIFIED WITH SPECIFIC SYSTEM DEDICATED PROGRAMS	1.7

Electromagnetic radiation and source elimination or ERASE technology provides the three services with alternate techniques for locating and homing on radar targets principaplly used by a potential enemy for surface-to-air missile systems and radar directed guns. The technology efforts supported by ERASE have provided improvements in our current antiradiation missile, SHRIKE and standard ARM in addition to the development of HARM. The current work being accomplished through ERASE includes development of an extended frequency coverage ARM seeker, development and prototype fabrication of an aircraft mounted radar site location system and continue investigations in multi-mode ARM guidance to attempt to solve the radar shutdown problems. The results of these efforts will support future weapon development efforts in future defense suppression weapons system.

Digitized by Google

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63306N	AIR-TO-SURFACE MISSILE GUIDANCE TECHNOLOGY	• DEVELOP MIDCOURSE AND TERMINAL GUIDANCE TECHNOLOGY FOR HIGH-SPEED, LONG RANGE MISSILES	1.7
	AIR-TO-SURFACE MISSILE PROPULSION TECHNOLOGY	• DEVELOP LOW VOLUME RAMJET PROPULSION TECHNOLOGY FOR FUTURE SUPERSONIC STANDOFF MISSILES	2.0

There are two projects within the advanced air launch air-to-surface missile systems program; guidance technology and propulsion technology. The first of these, guidance technology, is responsible for development of midcourse and terminal guidance which may be applicable to a long-range supersonic missile of the future. The technical approach in demonstrating high-velocity midcourse guidance is derived from work accomplished and emerging from the Ring Laser Gyro Technology project. Midcourse position update and terminal homing for this feasibility demonstration is using [deleted] correlation. This technique matches the [deleted] from surface cultural features with stored reference data for position error correlator as well as knowledge of target and position. This technique has been demonstrated under adverse weather conditions during captive flight. During fiscal year 1978, these two systems will be demonstrated in a supersonic dynamic test vehicle.

The propulsion unit supported under this program will be used on the dynamic test vehicle to test the midcourse and terminal guidance systems. Air-to-surface missile propulsion technology has supported development of an air-launched integral rocket Ramjet which combines a liquid fueled Ramjet with integral solid rocket booster. This Ramjet is capable of attaining speeds to mach [deleted] at sea level or mach [deleted] at 35,000 feet. It is planned to complete the flight test series of the Ramjet hardware during fiscal year 1978.

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63369N	AIR-TO-GROUND STANDOFF WEAPON	• DEVELOP TECHNOLOGY TO PROVIDE A MEANS FOR DETONATING AN EXPLOSIVE WARHEAD UNDER AN ENEMY SHIP KEEL USING AN AIR-LAUNCHED STANDOFF MISSILE	1.1

Exploratory development testing has proven the effectiveness of detonating a relatively small high explosive warhead under the keel of a surface ship. The air-to-ground standoff weapon project will continue the technology efforts directed toward utilization of [deleted] attacking enemy ships. In fiscal year 1978, the project will conduct system studies and investigations of aerodynamics, water entry, underwater trajectories, fuzing and lethality.

Digitized by Google

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVE	FY-78 FUNDING
63514N	AIRCRAFT AND ORDNANCE SAFETY	• REDUCE VULNERABILITY TO FIRE OR EXPLOSION DAMAGE CAUSED BY INADVERTENT ACTIVATION OF AIR LAUNCHED ORDNANCE	1.0

The available space on the carrier flight deck of ten requires that several aircraft servicing operations be conducted in close proximity. These include aircraft arming, fueling and rotuine maintenance. The aircraft and ordnance safety project supports continued evaluation of design techniques to ensure that weapon warhead, propulsion and other explosive devices provide the maximum possible protection against inadvertent activation. Prior efforts in this area have resulted in thermal protection for general purpose bombs and rockets. Future efforts will ensure that missile and weapon design development will incorporate the technology developed under this project.

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVE	FY-78 FUNDING
64603N	GATOR	• PROVIDE THE SERVICES AN AIR-SCATTERABLE LAND MINE FOR DELIVERY FROM FIXED WING ATTACK AIRCRAFT	1.0
	FUEL AIR EXPLOSIVES WEAPON (FAEII)	• PROVIDE THE SERVICES WITH A UNITARY FUEL AIR EXPLOSIVES WEAPON FOR DELIVERY FROM HIGH PERFORMANCE TACTICAL AIRCRAFT	7.7

There are two projects included in the unguided conventional air-launched weapons program. These are the Gator antipersonnel and antitank landmine and second generation fuel air explosive weapon, FAE II.

Gator is a triservice project with the Army developing the landmine and the Air Force as the lead service in development of the air-launched version of this mine. Navy funding is required to support necessary modification of the standard Navy dispenser to employ these mines. This project will provide the services with a common ground and air-dispensed target activated landmine.

The joint Navy and Air Force fuel air explosives weapon development, with Navy as executive service, will provide the services with a unitary weapon capable of delivery from a wide variety of tactical aircraft. Fuel air explosives are relatively new technology which will provide enhanced overpressure when compared to high explosives warheads.

NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVE	FY-78 FUNDING
64604N	BIGEYE	• DEVELOP A JOINT USE BINARY CHEMICAL WEAPON FOR AIRCRAFT DELIVERY OF [DELETED] AGENT FROM TWO NON-TOXIC CHEMICALS	2.2

Digitized by Google

The objective of the joint Navy and Air Force Bigeye development effort is to provide a binary [deleted] dispenser for delivery of [deleted] agent. The weapon is designed to employ two nontoxic chemicals until just prior to delivery [deleted]. The planned activity for fiscal year 1978 is to complete prototype fabrication and aircraft compatibility studies.

This concludes the overview of the Navy advanced and engineering air-to-surface armament projects. Colonel George Acree will now present the Air Force air-to-surface development projects.

AIR FORCE AIR-TO-SURFACE ARMAMENT

R&D PROGRAMS

PROGRAM ELEMENT	PROGRAM TITLE	FY78 FUNDING $ IN MILLIONS
64362F	GROUND LAUNCHED CRUISE MISSILE	27.9*
63601F	CONVENTIONAL WEAPONS	12.1
63609F	ADVANCED ATTACK WEAPONS	10.0
63741F	DEFENSE SUPPRESSION	2.9
64601F	CHEMICAL/BIOLOGICAL DEFENSE EQUIPMENT	0.4
64602F	ARMAMENT/ORDNANCE DEVELOPMENT	12.8
64604F	LOW ALTITUDE AIRFIELD ATTACK SYSTEM	20.5
64608F	CLOSE AIR SUPPORT WEAPON SYSTEM	57.9
64610F	AIR DELIVERED LAND MINES	10.6
64733F	SURFACE DEFENSE SUPPRESSION	29.8
64736F	FOREIGN WEAPONS EVALUATION	3.4
27162F	TACTICAL AIR-TO-GROUND MISSILES	2.3
		190.6

* PRESIDENT'S AMENDED BUDGET

There are 12 Air Force research and development program elements. You have already received briefings on the Maverick, GBU-15, and Harm programs. I will be addressing the specific objectives of each remaining element directly. The total fiscal 1978 funding for all air-to-surface programs is $190,600,000. Each program element consists of one or more major projects.

AIR FORCE AIR-TO-SURFACE ARMAMENT

R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY 78 FUNDING
63601F	ORDNANCE TECHNOLOGY	o DEMONSTRATE TECHNICAL FEASIBILITY OF ADVANCED UNITARY WARHEADS, CLUSTER MUNITIONS, FUZES, SUSPENSION & RELEASE EQUIPMENT, STORES MANAGEMENT SYSTEMS, AND AIR DELIVERED MINES	4.2
	AIR-TO-SURFACE GUIDED WEAPONS TECHNOLOGY	o DEVELOP PROMISING GUIDANCE, CONTROL, AND WEAPON INTEGRATION TECHNIQUES FOR ADVERSE WEATHER GUIDED WEAPONS	7.9

Conventional weapons technology is pursued in this line that contains the total Air Force advanced development effort for demonstration of nonnuclear weapons technology and associated weapons guidance technology. Conventional weapons technology efforts are included in this program for bombs, clusters, fuzing systems, aircraft/stores interface equipment, mine sensors, aircraft rockets, and adverse weather day-night air-to-surface weapon guidance units.

Digitized by Google

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63609F	RADIOMETRIC AREA CORRELATOR (RAC)	• INTEGRATE AN ALL-WEATHER, SELF CONTAINED GUIDANCE SUBSYSTEM WITH THE GBU-15 GUIDED GLIDE BOMB AND PREPARE FOR FREE FLIGHT TESTING	2.5
	HARD STRUCTURES MUNITION	• INTEGRATE AND FLIGHT TEST HSM WITH LASER GUIDED BOMB (LGB) KIT	3.4
	WIDE AREA ANTI-ARMOR MUNITION (WAAM)	• IMPROVE CAPABILITY BY PROVIDING INCREASED ARMOR KILLS PER SORTIE • INITIATE DESIGN STUDIES ON SENSOR FUZED SUBMUNITION, ANTI-ARMOR CLUSTER MUNITION, AND MILLIMETER WAVE GUIDANCE SYSTEM FOR THE MINI-MISSILE CONCEPT	2.9
	STANDOFF TARGET ACTIVATED MUNITION (STAM)	• FLIGHT TEST PROTOTYPE MINE TO PROVIDE CAPABILITY TO DESTROY TAXIING AIRCRAFT AND WHEELED VEHICLES	1.2

This program conducts prototype demonstrations of advanced guidance and warhead components for air-to-surface weapons. Four projects will be initiated in fiscal year 1978. The radiometric area correlator guidance subsystem will be integrated with the GBU-15 planar wing weapon to provide an accurate, adverse weather, self contained midcourse and terminal seeker for use against fixed targets. The hard structures munition will be integrated with the laser guided bomb kit to economically demonstrate this weapon and provide a near-term capability against hardened targets. The wide area antiarmor munition (WAAM) project will evaluate weapon concepts to improve anti-armor sortie effectiveness by increasing the number of armor kills per sortie. Finally, the standoff target activated munition system (STAM) will demonstrate the capability to disrupt ground movement to taxing aircraft and vehicles.

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
63741F	LORAN/GBU-15 DEMO	• PROTOTYPE DEMONSTRATION OF ALL-WEATHER MID-COURSE GUIDANCE FOR GBU-15	1.7
	HOJ/GBU-15 DEMO	• DESIGN AND DEVELOP PROTOTYPE HOME-ON-JAM GUIDANCE FOR FLIGHT TESTING TO PROVIDE CAPABILITY TO COMPLETE GBU-15 MISSION IN DATA LINK JAMMING ENVIRONMENT	1.2

The defense suppression line demonstrates system concept feasibility of various guidance, warhead and aerodynamic techniques for guided weapons designed to attack enemy defenses. The two prototype demonstrations on the GBU-15 are included. Loran is a near term midcourse guidance option. [Deleted] will provide terminal guidance against enemy [deleted].

Digitized by Google

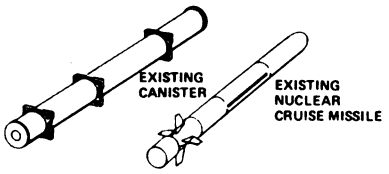
AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

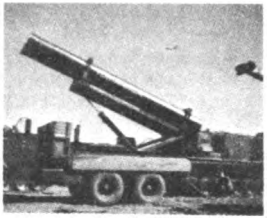
PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64362F	GROUND LAUNCHED CRUISE MISSILE	• PROVIDES HARDWARE/SOFTWARE DEVELOPMENT TO SUPPORT ADAPTION OF TOMAHAWK CRUISE MISSILE FOR GROUND LAUNCH. (AIR FORCE/NAVY)	~~3.9~~ 27.9*

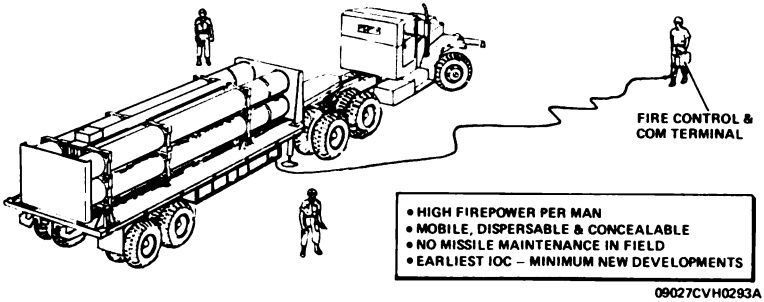
* PRESIDENT'S AMENDED BUDGET

The ground launched cruise missile is a joint Navy/Air Force program for a new start in fiscal year 1978. Cruise missile technology will be applied to provide increased firepower for nuclear and conventional tactical forces as required by TAF ROC 304–77. Specifically, the Navy Tomahawk cruise missile will be adapted into a weapon system for ground launch capability to release dual capable aircraft from quick reaction alert. The program initiates the full scale missile development and the hardware/software development necessary to support the weapons system. Additionally, the GLCM is a visual commitment to allies and enemy alike that we intend to perform the deep interdiction theater nuclear mission from mobile sites, thereby increasing weapon system survivability, while decreasing collateral damage through dispersal.

GROUND LAUNCHED CRUISE MISSILE






FIRE CONTROL & COM TERMINAL
• HIGH FIREPOWER PER MAN
• MOBILE, DISPERSABLE & CONCEALABLE
• NO MISSILE MAINTENANCE IN FIELD
• EARLIEST IOC – MINIMUM NEW DEVELOPMENTS
09027CVH0293A

A method of deploying and operating the nuclear GLCM system is to mount four of the existing Tomahawk nuclear cruise missiles on a carrier vehicle with necessary fire control and communications equipment. This approach increases fire power, can be dispersed and concealed, and provides the earliest capability through a minimum of new developments.

Growth from the nuclear capability through avionics will provide a conventional capability offering, in the mid-1980's, a wide varity of warhead options for employment as the situation dictates.

Digitized by Google

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64601F	BIGEYE	• DEVELOP A BINARY CHEMICAL WEAPON (NAVY LEAD/AIR FORCE)	0.4

Along with chemical and biological defensive equipment being developed in this line, the Air Force also supports the Navy Bigeye development to provide a capability to air deliver relaliatory binary chemical weapons.

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64602F	DISPENSER MUNITIONS	• DEVELOP DISPENSER AND SUBMUNITIONS FOR USE AGAINST AIRFIELDS, ARMOR, AND OTHER TARGETS	6.0
	BOMBS AND FUZES	• DEVELOP LOW COST IMPACT, DELAY AND PROXIMITY FUZES FOR USE WITH JOINT SERVICE BOMBS AND DISPENSERS	3.1
	FUEL AIR EXPLOSIVE (FAE), FLAME AND INCENDIARY	• DEVELOP HIGH SPEED FAE MUNITION (NAVY LEAD/AF)	0.7
	MUNITIONS HANDLING, CARRIAGE, AND RELEASE EQUIPMENT	• IMPROVE RETARD BOMB CAPABILITY (AF LEAD/NAVY) • DEVELOP COMMON BOMB RACK (AF/NAVY) • IMPROVE BOMB HANDLING CAPABILITY	1.9
	WEAPONS SUPPORT	• SUPPORT B-77 PARACHUTE FLIGHT TEST/DEVELOP SIMULATOR (AF/ERDA)	1.1

This wide ranging program is the engineering development source for aerially delivered conventional weapons. Its five projects include: the tactical munition dispenser with the combined effects bomblet; low cost, impact, delay, and proximity fuzes; and the joint Navy/Air Force high speed fuel air explosive (FAE) munition. Other joint projects with the Navy include the air inflatable retarder to improve retard bomb delivery and the development of a common bomb rack, the multiple stores ejector rack. This program also supports the energy research and development agency B-77 nuclear weapon development.

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64604F	DELETED AIRFIELD ATTACK SYSTEM	• DEVELOP A DELETED ATTACK AIRFIELDS DELETED DELETED	20.5

Digitized by Google

The low altitude airfield attack system is a new start in FY 1978. The program supports U.S. participation in the joint [deleted] if our initial projections are correct, this system will provide a unique and highly effective means of disrupting operation of [deleted] the program is an equal partnership led by the [deleted].

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64610F	GATOR MINE SYSTEM	• PROVIDE JOINT SERVICE ANTI-ARMOR MINE (AIR FORCE/ARMY/NAVY)	7.0
	UNGUIDED SUU-54 DISPENSER	• QUALIFY 2000 LB DISPENSER FOR MINE DELIVERY	0.2
	PIRANHA UNDERWATER MINE	• DETER RIVER FORDING WITH ANTI-ARMOR MINE	3.4

These three projects are included in the air delivered land mine program that provides a family of target activated munitions to counter moving targets. The Air Force leads the tri-service Gator project which consists of a mix of anti-armor and antipersonnel mines. The existing SUU-54 2000 pound cluster dispenser will complete qualification in an unguided version for mine delivery. The Piranha is a shallow water antiarmor mine for use against river fording or snorkelling armored vehicles.

AIR FORCE AIR-TO-SURFACE ARMAMENT R&D PROJECTS

PROGRAM ELEMENT	PROJECT TITLE	PROJECT OBJECTIVES	FY-78 FUNDING
64736F	FOREIGN WEAPONS EVALUATION	• PROMOTE INTERNATIONAL COOPERATIVE ACITIVITY BY EVALUATING FOREIGN WEAPON CONCEPTS AND EQUIPMENT [DELETED]	3.4

This program evaluates equipment and weapon concepts developed by foreign nations. [Deleted] antiarmor cluster munition will enter an advanced evaluation phase and testing of the Federal Republic of Germany's Strebo submunitions will be completed.

AIR FORCE/NAVY AIR-TO-SURFACE ARMAMENT RESEARCH AND DEVELOPMENT PROJECTS

SUMMARY

- JOINT AIR FORCE/NAVY EFFORTS
  - 59% OF PROJECTS
  - 67% OF PROJECT FUNDING
- JOINT AIR FORCE/NATO/ERDA
  - 13% OF PROJECTS
  - 13% OF PROJECT FUNDING

88-379 O - 77 - 12

Digitized by Google

In summary, 59 percent of the combined Air Force and Navy air-to-surface research and development projects are joint cooperative efforts. These joint projects account for 67 percent of the total funding. Additionally, another 13 percent of the Air Force projects and funding are joint endeavors with our NATO Allies and other Government agencies. This concludes the summary of Air Force and Navy air-to-surface armament research and development programs.

STANDOFF PRECISION GUIDED WEAPONS

NEED

- REDUCE LOSSES TO SAM/AAA
- IMPROVE SINGLE ROUND EFFECTIVENESS

METHOD

- AVOID DEFENSES
- STANDOFF GUIDED WEAPONS
- LAUNCHED FROM BEYOND RANGE OF DEFENSES

Due to the committee's interest, I will now report on the status of joint Navy and Air Force activities in standoff precision guided weapons. The need for standoff weapons became apparent during our southeast Asian experiences with surface-to-air missile and anti-aircraft artillery. This need was reinforced by Israeli experience with the improved surface-to-air defenses they faced in 1973. These experiences indicated the need for better methods to reduce losses to SAM and AAA while improving single round effectiveness. The method agreed to concentrates on avoiding hostile fire by launching highly accurate guided weapons from beyond the lethal range of air defenses.

STANDOFF PRECISION GUIDED WEAPONS

CURRENT DEVELOPMENTS

- o HARPOON (NAVY)
- o MODULAR GUIDED GLIDE BOMB (GBU-15) (AIR FORCE)
- o LASER SEEKER (JOINT) > MAVERICK, GBU-15, WALLEYE
- o IIR SEEKER (JOINT)
- o HARM (JOINT)

FUTURE DEVELOPMENTS

- o STANDOFF WEAPONS (JOINT)

Both services recognize standoff precision guided weapons as a viable method to accomplish our missions against heavily defended targets. Currently, the Navy is developing the Harpoon and the Air Force is developing the Modular Guided Glide Bomb GBU-15. We are working together on laser and imaging infrared seekers for Maverick, GBU-15 and Walleye, plus the high speed antiradiation

Digitized by Google

missile (HARM) which were discussed earlier. For the future, we are working to jointly define a new generation of standoff weapons which will meet our need for sufficient standoff and accuracy to effectively accomplish our missions in increasingly difficult environments. I will now review these joint efforts.

STANDOFF WEAPON REPRESENTATIVE REQUIREMENTS

	TACOPS	SOC
TARGETS	MOVING SEA	LAND
STANDOFF RANGE	DELETED	DELETED
OPERATING ENVIRONMENT	ALL WEATHER	ALL WEATHER
	LOW TO MEDIUM ALTITUDE	MEDIUM TO HIGH ALTITUDE

DELETED

This viewgraph illustrates representative requirements of the two services' studies in areas of primary interest. Against these classes of targets the varying depth of defenses dictate a need for different standoff ranges. Postulated Soviet ship defenses dictate a requirement for about [deleted] nautical miles standoff while attack of land targets situated well behind the FEBA require standoff of approximately [deleted] nautical miles according to the SOC study. All weather attack capability from medium altitude is a common requirement for both services. Carrier operations are best suited for stores weighing approximately [deleted] pounds while the environment of land based operations permit the Air Force to use weapons up to about [deleted] pounds. We recognize and appreciate these differences.

FUTURE PLANS

- REFINE STUDY RESULTS
- DEVELOP JOINT SERVICE OPERATIONAL REQUIREMENT (JSOR)
- INITIATE JOINT PROGRAM

  POWERED
LONG RANGE
ALL WEATHER > PRECISION GUIDED WEAPON FAMILY

  MAXIMIZE SYSTEM/COMPONENT COMMONALITY

  AVAILABLE IN LATE 1980's

Digitized by Google

While target priorities and operating environments vary, we believe that further refinement of these requirements in relation to technological capabilities can lead to a practical development program. On the basis of this perception, we are working together to develop a joint service operational requirement (JSOR) for long range tactical strike weapons. Successful completion of this JSOR will lead to initiation of a joint service program to produce a precision guided weapon family of powered, long range, all weather weapons, tailored to service needs, that maximize system and component commonality. This is our basic approach to provide us with the necessary standoff weapons to perform our tactical missions in the late 1980's.

Thank you, Mr. Chairman.

Senator CANNON. We will stand in recess until 9 o'clock tomorrow morning. Thank you very much.

[Whereupon, the subcommittee recessed, to reconvene at 9 a.m., the following day.]

Digitized by Google

MILITARY PROCUREMENT, FISCAL YEAR 1978

FRIDAY, MARCH 11, 1977

U.S. SENATE,
SUBCOMMITTEE ON TACTICAL AIR
OF THE COMMITTEE ON ARMED SERVICES,
Washington, D.C.

ELECTRONIC WARFARE PROGRAMS

The subcommittee met, pursuant to notice, at 9:05 a.m., in room 224, Russell Senate Office Building, Senator Barry Goldwater presiding.

Present: Senator Goldwater.

Also present: Charles Cromwell and Bob Old, professional staff members.

CHAIRMAN'S OPENING STATEMENT

Senator GOLDWATER. This morning the subcommittee will review the electronic warfare programs of the three services that fall in the tactical air power area. The programs include the Navy EA–6B and Air Force EF–111 high-powered support jammer aircraft, the radar warning and self-protection jammer equipment, and an overview of electronic intelligence gathering aircraft. In addition we will review with the Army their Elint collecting and jamming aircraft, and their radar warning and self-protecting jammer equipment programs.

Our principal witnesses today are Lt. Gen. Alton D. Slay, USAF, Deputy Chief of Staff, Research and Development; Rear Adm. Robert C. Mandeville, Director, Naval Aviation Plans and Requirements; and Brig. Gen. Charles E. Canedy, USA, Deputy Director of Requirements; and Army Aviation Officer, Office of Deputy Chief of Staff for Operations.

General Slay, you can take over. I know you are supposed to be with Senator McClellan at 10 a.m. and that might be a little more important.

Digitized by Google

STATEMENTS OF LT. GEN. ALTON D. SLAY, DEPUTY CHIEF OF STAFF FOR RESEARCH AND DEVELOPMENT; REAR ADM. ROBERT C. MANDEVILLE, DIRECTOR, AVIATION PLANS AND REQUIREMENTS, DCNO (AIR WARFARE); AND BRIG. GEN. CHARLES E. CANEDY, DEPUTY DIRECTOR OF REQUIREMENTS, AND ARMY AVIATION OFFICER, OFFICE OF DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS, ACCOMPANIED BY MAJ. GEN. ABBOTT C. GREENLEAF, DIRECTOR OF PROGRAMS, DSC/P. & R., USAF; MAJ. GEN. TIMOTHY I. AHERN, ASSISTANT DEPUTY CHIEF OF STAFF/RESEARCH AND DEVELOPMENT, USAF; BRIG. GEN. ROBERT M. BOND, DEPUTY DIRECTOR OF OPERATIONAL REQUIREMENTS, DSC/R. & D., USAF; CAPT. MICHAEL G. BASFORD, HEAD, BUDGET AND LEGISLATIVE SECTION, DCNO (AIR WARFARE), USN; AND CAPT. JAMES H. ECKART, HEAD, AVIATION ELECTRONIC WARFARE SECTION, DCNO (AIR WARFARE), USN

General SLAY. Yes, sir, not more important, sir, but just a prior arrangement.

The EA-6B is first, with Comdr. Ron McDivitt, the Deputy Program Director giving that.

EA-6B PROGRAM REVIEW

Commander MCDIVITT. The EA-6B Prowler is a four seat tactical electronic warfare version of the Grumman A-6 attack aircraft. The EA-6B is the only operational airborne weapons system in our inventory that is totally dedicated to active electronic warfare in support of strike forces. This weapons system was successfully employed in combat operations in Southeast Asia. The Prowler electronic warfare system, designated ALQ-99, is the same tactical jamming system being used in the U.S. Air Force EF-111 development program also being conducted at the Grumman Aerospace Corp.

PRIMARY MISSIONS

STRIKE SUPPORT

INCREASE SURVIVABILITY AND STRIKE EFFECTIVENESS

SUPPRESS/DEGRADE VICTIM DEFENSE SYSTEMS

FLEET DEFENSE

ACTIVE/PASSIVE FORCE DEFENSE

TACTICAL SUPPORT JAMMING AT SEA

Digitized by Google

The primary mission of the EA–6B is to provide all-weather active tactical electronic jamming support for transiting airborne strike forces and to provide both active and passive support for overall fleet defense. The main thrust of the EA–6B mission is the denial to the enemy of selected radar information such as that required for [deleted]. Additional mission capabilities include battlefield surveillance, [deleted] electronic signal reception, analysis, and collection.

The tactical jamming system, as installed in the EA–6B, is divided into two major subsystems. The onboard system is depicted here and is internal to the airframe itself. This subsystem consists of the signal receivers, operator displays and controls, and a central computer. Received signals are processed by the computer and are evaluated [deleted]. Selected signals are then prioritized for either automatic or manual jamming. A digital recorder functions as a repository for the mission electronic environment and provides for deliberate and detailed postmission analysis and reconstruction. If the mission requires only electronic surveillance and data collection, this subsystem is all that is required and as many as five external fuel tanks can be carried to extend the mission range and/or endurance.

This overlay shows the jammer subsystem which is housed externally carried pods. As many as five pods can be carried depending on mission requirements, with each pod having the capability of jamming [deleted] separate signals.

A typical pod has a self-contained power source driven by ram air. Each pod contains two jammer transmitters with [deleted] the low band pods. The smart box of the jammer subsystem is the exciter, which receives the commands of the onboard system and provides the [deleted] for the transmitters. Any of six different pods offering coverage in eight frequency bands may be carried, with the proper pod loading being dictated by the anticipated threat.

EA-6B WEAPON SYSTEM EVOLUTION

BASIC EA-6B JAN 1971	EXPANDED CAPABILITY (EXCAP) JAN 1973	IMPROVED CAPABILITY (ICAP) MAR 1976	IMPROVED CAPABILITY PHASE II (ICAP II) FY 1980
• LIMITED FREQ.	• EXPANDED FREQ.	• DIGITAL RECEIVERS	• IMPROVED JAMMERS
		• NEW DISPLAYS	• USAF COMMON
• TRACK RECEIVER	• EXCITER	• IMPROVED OPERATOR EFFICIENCY	• NEW EXCITER (MULTI BAND)
• TO BE MODIFIED TO ICAP	• DIGITAL RECORDER	• SOFTWARE	
	• IMPROVED BUILT IN TEST	• NEW COM/NAV	
	• AUTO MODES	• AUTO CARRIER LANDING	
		• RELIABILITY	
			• RELIABILITY
			• IMPROVED AUTO MODE

Digitized by Google

The evolution of the EA–6B has been dynamic due to the ever-changing threat in electronic warfare. The basic system was an outgrowth of the EA–6A system and was produced primarily to provide some defense against the Southeast Asia surface-to-air missile threat. [Deleted.] All basic aircraft, on the left there, are being modified to the latest production configuration or the improved capability configuration.

Frequency expansion was required to cover additional threats and thus our expanded capability or EXCAP aircraft became part of the inventory in 1973. The exciter modulator was introduced and permitted [deleted]. A digital recorder was added to record mission data and the first automatic system operation was available to cope with high-signal density in heavily defended areas. In 1976, the improved capability version of the EA–6B was introduced and is currently in production. The major thrust of the improved capability or ICAP system was to provide state of the art technology to the onboard subsystem. This included new digital receivers and digital TV type displays for the operators. These changes combined with the rearrangement of the cockpits to put both electronic warfare operators in the rear cockpit provides an order of magnitude improvement in response time and system efficiency. Also included in ICAP were improved communication and navigation equipment and an automatic carrier landing system. Also, improved pilot instrumentation and increased reliability.

Phase 2 of the improved capability or ICAP II is presently a funded study program to identify improvements to the jammer subsystem that will be required in the fiscal year 1980 and subsequent time frames. If this program is approved for production in fiscal year 1980, all of the EXCAP aircraft would then be modified to this configuration. A new exciter, based on present Air Force developed technology is the primary tool for achieving the desired goals of the ICAP II development program. The envisioned new exciter would provide complete flexibility [deleted].

Additional items being investigated during the present study include [deleted] and others as indicated.

The Air Force EF–111 development program utilized the technology in this evoluation through the ICAP version and has improved in some areas on the ICAP system. ICAP II is likewise benefiting from EF–111 and B–1 technology and should provide the latest state of the art hardware available for tactical electronic warfare.

EA-6B PROGRAM STATUS

- PRODUCTION ON SCHEDULE
- IMPROVED CAPABILITY (ICAP) TEST AND EVALUATION ON SCHEDULE
- IMPROVED CAPABILITY PHASE TWO (ICAP II) STUDY ON SCHEDULE
- NINE FLEET SQUADRONS COMMISSIONED
- USMC INTRODUCTION ON SCHEDULE
- UPD[illegible] RAM ON SCHEDULE

Digitized by Google

As indicated, all phases of the production and follow-on development are scheduled, 9 of the 12 fleet squadrons have been commissioned with the 10th scheduled for establishment in early 1979. Marine Corps introduction is progressing smoothly and the update program from basic to ICAP configuration is on schedule. With respect to each of these programs, all costs are within budgeted amounts.

EA-6B PROCUREMENT STATUS

INVENTORY OBJECTIVE: [deleted]

- NO CHANGES IN PROCUREMENT PLAN DURING PAST YEAR
- INVENTORY AS OF 1 JAN 1977: 53

	FISCAL YEARS			
FY 77 & PRIOR	78	79	80	TOTAL
72	6	6	6	90

USN SQDS [illegible]

USMC SQDS [illegible]

FLEET READINESS SQD. [illegible]

PIPELINE [illegible]

FORCE LEVEL ASSURANCE [illegible]

R&D/PREPROD [illegible]

TOTAL PROCUREMENT [illegible]

(LOSSES TO DATE) [illegible]

There have been no major changes in the production program in this budget submission. Production is scheduled to continue through fiscal year 1980 at a rate of 6 per year for a total program of 90, including one R. & D. aircraft. With respect to force levels, the present inventory objective through the 5-year defense plan is [deleted]. The plan provides for only 36 aircraft for 12 Navy squadrons or 3 EA–6B's per squadron. It is the Navy's position that a requirement for four aircraft per squadron is real and does exist. The force level reflected in this budget submission is due to prior year funding constraints.

In the fiscal year 1979 planning and programing process that is now ongoing, several procurement alternatives are being examined to increase the Navy EA–6B force level to a 48-unit equipment level that will provide for 4 aircraft per squadron for 12 Navy squadrons.

Digitized by Google

EA-6B IMPROVED CAPABILITY MILESTONES

• FIRST FLIGHT	JUL 75
• FIRST PRODUCTION DELIVERY	MAR 76
• DELIVERY TO FLEET	JUL 76
• TECHNICAL EVALUATION COMPLETE	AUG 76
• OPERATIONAL EVALUATION COMPLETE	JUL 77
• NAVY SUPPORT DATE	SEP 77
• FIRST DEPLOYMENT	[deleted]

All milestones in the ICAP program have been met. Completion of the operational evaluation is scheduled for this summer. Deployment of the first ICAP squadron is scheduled [deleted].

EA-6B IMPROVED CAPABILITY PHASE TWO MILESTONES

STUDY APPROVED	MAY 76
STUDY COMPLETE	MAY 77
DEVELOPMENT DECISION	JUL 77
PRODUCTION DECISION	OCT 79
FIRST PRODUCTION DELIVERY	MAR 81

Digitized by Google

Following the completion of the ICAP II study in May of this year, a tradeoff analysis will be conducted leading to a go-or-no-go decision in continuing ICAP II development. If a favorable decision on development is attained, a production decision is required in sufficient time to provide fiscal year 1980 production incorporation.

USMC EA-6B PROGRAM

• AIRCREW TRAINING (NAS WHIDBEY ISLAND)	MAR 77
• FIRST AIRCRAFT	MAR 77
• FIRST DETACHMENT	SEP 77
• SECOND DETACHMENT	SEP 78
• MCAS CHERRY POINT	DELETED
• FOWARD DEPLOYED SITE	DELETED
• TOTAL AIRCRAFT DELETED	MAR 80

The Marine Corps introduction of the EA–6B is progressing as scheduled. Funds required for the second USMC support site are included in the present budget submission. Complete [deleted] capability for mobile land based operations will be available during the spring of [deleted] coincidental with delivery of their [deleted] ground support outfitting, which will be included in next year's budget submission.

Digitized by Google

EA-6B BREAKDOWN OF FY 78 FUNDS

ITEM		MIL $	QTY
RESEARCH AND DEVELOPMENT		0	
PRODUCTION		138.0	
AIRCRAFT & CHANGES	58.8		
GFE: ELECTRONICS	21.2		
OTHER	8.6		
NON-RECURRING	0		
SUPPORT	49.4		
	138.0		
LESS ADV. PROC.		-8.3	
		129.7	
FY 79 ADV. PROC.		8.1	
INITIAL SPARES		5.4	
MILCON		0.4	
PROGRAM COST FY 78		143.6	6
PRIOR YEAR COST		1,599.3	72
COST TO COMPLETE		278.5	12
TOTAL PROGRAM		2,021.4	90

This funding breakdown is for the complete fiscal year 1978 program, which includes six ICAP aircraft, three complete support sites, two organizational, and one intermediate, and other necessary support for the program.

Digitized by Google

EA-6B PROCUREMENT BUDGET PLAN

(FIVE YEAR DEFENSE PLAN)

	FY 78	FY 79	FY 80
PROCUREMENT			
QTY	6	6	6
COST:			
FLYAWAY	88.6	93.3	99.4
SUPPORT	49.4	52.5	25.5
AP P. Y.	-8.3	-8.1	-8.7
AP C. Y.	8.1	8.7	–
INITIAL SPARES	5.4	8.8	7.1
MILCON	0.4	–	–
PROCUREMENT (TOTAL)	143.6	155.2	123.3

This indicates the funding plan for the completion of the 90 aircraft program as we know it today, with the last production buy in fiscal year 1980.

EA-6B UPDATE PROGRAM

(FIVE YEAR DEFENSE PLAN)

- TOTAL PROGRAM: 41 AIRCRAFT
  - FIRST INDUCTION OCT 76
  - AT GRUMMAN CORP
  - TOTAL PROGRAM COST

41 AIRCRAFT	122.2 MILLION
ASSOCIATED SPARES	29.0 MILLION

EA-6B UPDATE & PROGRAM (FY 1978)

- FY 1978 PROGRAM: 11 AIRCRAFT
  - FY 1978 COST 15.8 MILLION

Digitized by Google

The EA–6B update program is underway and will modernize older aircraft to the latest production configuration. The total program provides for update of 21 basic aircraft, which will be complete in March 1979 and 20 EXCAP models scheduled for completion in the 1982–1983 timeframe. The program is being conducted at Grumman Aerospace Corporation with the fifth aircraft being inducted this month. All wiring is being replaced and the end product will have a complete improved capability jamming system. The first delivery is expected in June of this year. All 21 existing basic aircraft will be updated to the ICAP version with the EXCAP aircraft being updated to ICAP or ICAP II depending on the ICAP II production decision.

SUMMARY

- EA-6B PRODUCTION ON SCHEDULE
- IMPROVED CAPABILITY TESTING ON SCHEDULE
- NO MAJOR PROGRAM CHANGES IN FY 78
- FY 78 REQUEST INCLUDES:
  - 6 AIRCRAFT
  - USMC INTRODUCTION/SUPPORT
- UPDATE PROGRAM ON SCHEDULE

In summary, the EA–6B program is on schedule and within the authorized funding profile. Electronic warfare is a business requiring constant engineering investigation into future requirements. Now that the U.S. Air Force is approaching production of a similar tactical jamming platform, the combined efforts of both services in production efficiency, technical development and operational analysis will provide a much broader base for improving this important part of modern day warfare and maintaining parity with the threat. That concludes my presentation.

FORCE LEVELS

Mr. CROMWELL. Commander, the Navy's EA–6B program planning, you say, is based on one 3-plane squadron for each of the 12 carriers. That is a 36 UE total. But actually, if you include the advanced attrition buy in here, isn't the Navy ending up with enough airplanes to equip the 4 UE per squadron of 48 aircraft total program by the time those are delivered?

Commander MCDIVITT. No, sir; I don't think so. With the present number of aircraft that we have, it permits only enough to retain a 3 per squadron UE for 12 squadrons through about fiscal year 1985. It is true that now, since we only have 9 squadrons established,

Digitized by Google

that we can maintain 4 per squadron with that 36 UE but I cannot see that we can retain 4 per squadron with the 90 aircraft buy we presently have planned.

Mr. CROMWELL. Well, it would look like you would be able to support the 4 per squadron in the 1980 to 1981 or 1982 timeframe. Then the projected attrition would start to drop you below that.

Commander MCDIVITT. Yes, sir.

Mr. CROMWELL. So really if Congress approves those next 18 airplanes, you will be able to obtain the four per squadron capability for a while, and the real problem is the advanced attrition, the continuing attrition out through the 1980's.

Commander MCDIVITT. Yes, sir.

EA–6B MODERNIZATION PROGRAM

Mr. CROMWELL. Now, you are showing an ambitious updating program for the earlier models.

What is the average cost to bring those 41 early airplanes up to the new configuration, and, by contrast, what would it cost to buy 41 new airplanes in the new configuration?

Commander MCDIVITT. Yes, sir. The unit cost this year for new aircraft is about $14.8 million. To update the basic aircraft to the ICAP configuration is costing about $3.6 million.

Mr. CROMWELL. That is a cost-effective modification.

Commander MCDIVITT. Most assuredly.

Now, it is my estimate that to update the EXCAP to ICAP or ICAP II will cost approximately between $2.5 million to $2.75 million per airplane. That will also be a very cost-effective program.

Mr. CROMWELL. How many airplanes are in the modification program at any one time, and therefore out of service?

Commander MCDIVITT. Presently we will have as many as seven aircraft in the modification program at any one time.

Mr. CROMWELL. Now, is this causing any problem with the fleet squadrons having enough airplanes available for training and then deployment?

Commander MCDIVITT. No, sir, not in this time frame. This could cause some problems in the 1981–82 time frame, when we modify the second group of airplanes, the expanded capability airplanes to a later version, but right now it is no problem.

Mr. CROMWELL. When I was at Whidbey Island in January, the operational units out there were complaining that they didn't have enough airplanes available, and the squadrons were flying with two airplanes until they got ready to deploy on a carrier. They had enough for the deploying outfits and the squadrons that were training or getting ready to deploy, but the squadrons that had just come off a cruise were apparently short.

Any comment on that, or can you check into that?

Commander MCDIVITT. Well, I will be glad to check it, yes, sir. The last standard version squadron to deploy will return this fall, late this fall, so the standard version airplanes were not really scheduled to deploy past this year anyway, and we are only putting 10 of the 21 into the modification program anyway. But I will be glad to check into that, yes, sir.

Digitized by Google

INVENTORY OF JAMMING PODS

Mr. CROMWELL. How is the Navy's inventory of jamming pods?

Commander MCDIVITT. The Navy's inventory of jamming pods, as it stands right now, is sufficient for the number of airplanes that we have. It is part of the planning and programing process for next year's budget to possibly include additional jamming pods in that budget.

Mr. CROMWELL. How many pods does the Navy have now?

Commander MCDIVITT. The Navy presently has in its program 210 complete pods, with 44 extra sets of transmitters and exciters.

Mr. CROMWELL. Is that enough for 90 airplanes?

Commander MCDIVITT. With the Marine Corps on board, that will probably not be enough, sir.

Mr. CROMWELL. You will be looking to a buy of additional pods in the future?

Commander MCDIVITT. Yes, sir. It is my intention to attempt or to ask for an additional pod buy coincidental with the start-up of the EF-111 transmitter and exciter production line.

SQUADRON FORMATION PLAN

Mr. CROMWELL. What is your schedule for forming new squadrons to bring you up from the 9 to the 12?

Commander MCDIVITT. Presently there are two squadrons to be established in the first quarter of calendar year 1979, with the last one to come somewhat after that, and I don't—I can provide that for the record. I don't know when the 12th squadron right now is scheduled to form.

[Additional information follows:]

The 12th squadron is scheduled to be established during the last quarter of calendar year 1979.

Mr. CROMWELL. Are the Marines filling up in the interim?

Commander MCDIVITT. The Marines will get five aircraft this calendar year, four aircraft in calendar year 1979, five in 1980, and one in 1981. At that time they will be complete with their 15 aircraft capability and their three detachment capability.

Mr. CROMWELL. How many carriers are outfitted right now to support EA-6B's and what is the schedule for equipping the remainder of the carrier fleet?

Commander MCDIVITT. There are presently 10 carriers equipped to handle EA-6B's. The *Eisenhower* and the *Vinson* will be equipped very shortly, and that will put us up to the 12 capability.

Mr. CROMWELL. So you are going to be spreading 9 squadrons over 12 carriers for a period of time.

Commander MCDIVITT. Nine squadrons over 10 carriers until early next year, and then over 11, and then when *Vinson* comes in, by that time we expect to have additional squadrons.

READINESS RATES

Mr. CROMWELL. What is EA-6B's operational readiness rate and maintenance man-hours per flight hour?

Digitized by Google

Commander McDivitt. The material operational readiness rate for the EA–6B over the past year has averaged about 54 to 56.

Mr. Cromwell. How about full systems capable?

Commanader McDivitt. Full systems capable has been in the area of 42 percent, plus or minus one or two. As far as the maintenance man-hours per flight hour, it is running between 50 and 52.

Mr. Cromwell All right.

Could you provide for the record the monthly figures for the last year?

Commander McDivitt. Most certainly, yes, sir.

[The information follows:]

12-MO READINESS DATA FOR EA–6B

[FEBRUARY 1976–JANUARY 1977]

	Operational readiness	Full system capable	Maintenance man-hours per flight hour
February	[Deleted.]	[Deleted.]	46.8
March			45.4
April			55.0
May			45.3
June			42.7
July			50.8
August			48.8
September			47.7
October			51.2
November			45.4
December			47.2
January			50.3
Year's average			48.0

Mr. Cromwell. Now, on the maintenance man-hours, what are the items, what are the high maintenance items, the airframe items, or are they part of the jamming system?

Commander McDivitt. From a hardware standpoint, probably the highest item for maintenance man-hours per flight hour is the ALQ–99 tactical jamming system. However, this system has 95 individual black boxes in it, and it would probably be expected to be the highest one; even though it is high, it is a fairly reliable system.

Mr. Cromwell. Would you supply for the record what the top ten items are and maintenance man-hours per flight hour averaged over the year?

Commander McDivitt. Yes, sir.

[The information follows:]

12-month readiness degradation items for EA–6B, February 1976 to January 1977

System:	*Maintenance man-hour per flight-hour*
ALQ–99 tactical jamming system	3.387
CNI equipment	1.218
APQ–92 radar	1.059
J52–P–408 engine	.994
ALQ–129 radar	.459
Flight reference equipment	.435
APN–153 Doppler radar	.419
Hydraulic components	.331
ASH–30 recorder	.147
ARC–105 radio	.133

88-379 O - 77 - 13

Digitized by Google

Mr. CROMWELL. The operational pilots told us when we visited Whidbey that they want to carry the Harm missile on the EA–6B. They want to be able to shoot back.

Is that in the Navy's planned program?

Admiral?

Admiral MANDEVILLE. Mr. Cromwell, we have looked at this from time to time but have never discarded it, and we will not do this. It comes up almost yearly, the requirement or the perceived requirement. No formal requirement has been established by the CNO. I guess we are not sure in our own minds that the airplane will be in a position where the Harm missile will or will not protect, if you will. If it is accompanied, it will be accompanied by aircraft dedicated to the job. We wouldn't be sending it alone into a threat environment by itself without some strike group around it, and if you are going to have a strike group ingressing or egressing from a target area, you will have hopefully some kind of Harm support with it.

So we have not closed the door, but we have no hard plans at this time to equip it with any kind of antiradiation missile.

Mr. CROMWELL. It is a very understandable human desire to have on Harm on the EA–6B.

Admiral MANDEVILLE. Yes, sir, that is right.

Mr. OLD. Commander, is there any difficulty in putting four aircraft per squadron on the carrier decks? Are you running into any sort of deck space limitation by going to this number; namely, the number of attack aircraft and fighter aircraft that you also plan to have on the carrier deck?

Commander MCDIVITT. No, sir, I don't feel that there is at all. As a matter of fact, recent information from the operational commanders indicate that they would like as many EA–6B's, so to speak, as they can get of the latest version, and when airplanes are asked to leave the carrier for one reason or another, the EA–6B is the last one to go.

Admiral MANDEVILLE. That is a correct statement.

Mr. OLD. Well, when you do get to 4 aircraft per squadron, and you have 2 squadrons of tactical fighters on board of carriers, and 2 squadrons of attack aircraft so that is 48 there, plus the 4 EA–6B, plus other support aircraft, will you be able to carry a full complement of aircraft that each squadron is allowed to have? Is there enough deck space to do that?

Admiral MANDEVILLE. Yes, sir, we are deploying four now. All of our deployments are four aircraft. The UE, although it is established at three for the time, we are in a position—and that was what Mr. Cromwell was relating to earlier—that when a squadron leaves, it leaves with four airplanes, and that has been the case from our very first deployment.

So the deployment aspects of the four planes versus three is being—we are experiencing that right now.

Mr. OLD. And at the same time you are deploying full UE of attack and fighter aircraft.

Digitized by Google

Admiral MANDEVILLE. Of course, there are times when we will modify the mix of aircraft aboard. We have some F–14 shortages on one carrier right now because of the modification program on the F–14's.

Mr. OLD. Well I guess the question really is, when you look at the time period of F–14's and F–18's, and the EA–6B, and the others that are to make up the complement of the carrier wing, is there adequate deck space to take the full UE on board?

Admiral MANDEVILLE. We in peacetime do not normally have all the airplanes on board, to answer your question.

Mr. OLD. No; that doesn't answer the question.

Is there adequate space on board?

Admiral MANDEVILLE. There is physical room to put them on board, yes, sir. There is physical space to put them on board the carrier. We normally in peacetime do not operate with the entire air wing aboard.

Senator GOLDWATER. Does that apply to any size carrier?

Admiral MANDEVILLE. Yes, sir.

I would say yes, sir, we can physically put them aboard, but we don't like to work under those extreme conditions because of the safety aspects. We are just trying to make the thing as efficient and easy to work as possible because of the long in-port periods associated with the peacetime environment.

Mr. OLD. When you in fact get in a wartime environment, you kind of complicate things when you bring on board the full required complement of aircraft which you have not been practicing in peacetime.

Admiral MANDEVILLE. We would expect, as we did, in the recent go in Vietnam, of course, that the rate of flying and the operational mode will be on a much higher basis, and therefore you don't have to worry about spending so much time in port and regaining proficiency, not only the pilot proficiency but the handling people as you come out of an extended in-port period.

Mr. OLD. OK, thank you, sir.

Senator GOLDWATER. General, do you have another?

General SLAY. Yes, sir. The next one is Col. Jim McKenna, who is program director for the EF–111.

EF–111 PROGRAM REVIEW

Colonel MCKENNA. Senator Goldwater, gentlemen, sir, I would like to follow Commander McDivitt's presentation by describing first the differences between the F–111 and the modified EF–111A that are necessary to incorporate the ALQ–99 extremely high-powered jamming system as a principal part of this ECM system for the Air Force.

We have two F–111A aircraft in the development stage. The F–111A is being modified by revising equipment on the right-hand crew station of the crew capsule to contain displays and controls, as in this photograph, for the operation of the ALQ–99. We have also added a self-protection system called the ALQ–137, and a terminal threat warning system called the ALR–62 to the ECM subsystem makeup.

Digitized by Google

We are installing [deleted] of the ALQ-99 high-powered jamming transmitters, and five new developing exciters from the basic Navy technology in a pallet in the weapons bay of the aircraft. So we will be able to carry [deleted] jammers and five exciters to control in these jammers independently of any frequency restrictions for any given day of operation.

The receivers of the ALQ-99 are housed on the top of the fairing of the vertical tail of the plane. We have changed the power supplies on the aircraft. The standard F-111A has 60 KVA generators on it. We have changed those to 90 KVA systems to give us the extra power to allow the ECM gear to operate. And lastly, we have changed the cooling system to provide enough cooling at subsonic or supersonic speeds to cool off the exciters and transmitters in the weapons bay area.

Now I would like to go through the program status since we last testified for this program, last year. The first photograph shows the third aircraft in our program. This is an F-111A taken from the storage area at Davis-Monthan Air Force Base, and mounted on top of a pedestal located at Rome Air Development Center in New York. We put the aircraft there, and it will be there throughout the life of the R. & D. program to allow us to design, in real time, antennas for the receivers and the jamming transmitters. They radiate across a valley where there are sentry pickups, and so now we have full developed antenna pattern for the new jamming antennas for this weapon system.

The aircraft will stay there to evaluate any changes in our design as they occur. We go right back on the model and work again in real time on the changes.

Senator GOLDWATER. Let me ask, what does that receiver pod do to the performance of the aircraft?

Colonel MCKENNA. As far as the speed, sir, we have the aircraft flying its full envelope at altitude and on the deck, with probably about a [deleted] restriction, and we have had the model in the NASA Ames wind tunnel at 1/30 scale and also at NASA at Langley for blowdown flutter tests. We are getting into our first flight test series. With the pod on the tip of the vertical stabilizer we are improving our landing characteristics from the basic aircraft itself, likened to feathers on the end of an arrow.

I will get into this later on, sir.

We had our first full-up aircraft flight yesterday. The test pilots reported that the aircraft handled exactly like the clean aircraft they flew last year. This is preliminary datum, but we are encouraged with it.

Commander McDivitt mentioned we used the Navy ALQ-99 system. We made some changes to it, principally in the area of the exciter, which gives the commands to the jammers, so they can jam on the right frequency areas. This exciter was installed on a housing at [deleted] test range in September of this past year. We operated the exciter against one of the actual radars to determine, in engineering prototype

Digitized by Google

test, the jamming characteristics of this changed device, and we obtained quite a bit of beneficial data which helped our design as we now go into further ground and flight testing.

The tests against the radar were very successful from this viewpoint.

We are now conducting the Redcap testing which is a ground simulator owned by the Calspan Corp. of Buffalo, N.Y. The Redcap simulator enables engineering examinations of our changes to the ALQ–99, the jamming system, as they would be played against the radar environment of the East European scenario.

This photograph shows, in general, at least, what is at the Calspan simulator. [Deleted.]

We have personnel from Tactical Air Command and Aerospace Defense Command at the site who are actually manning scopes. The equipments from the EF–111A which are in the simulator are the exciters and the transmitters that are generating the actual power and jamming techniques that we will demonstrate in the airborne operation very soon.

They now are operating actual scopes, so we effectively have a Soviet filter center established to challenge the ECM capability of [deleted].

This is a photograph of a reverse screen projection. This facility is one of a kind in the Nation. It is the only place we can effectively bring out the very dense environment, under laboratory conditions prior to flight testing of the equipment itself. This is an operation now that will go on for the next 3 months.

This is a photograph, sir, of our first flight yesterday. It got off the ground, we flew 1 hour 48 minutes. The aircraft landed in a full up condition, and we are flying against this coming Monday. We will be flying the aircraft the first 3 months of the flight test program to get structural data for the changes.

We mentioned the vertical fin is new. The fincap has been put on top of that. You can just see the radome in this position that covers the jamming antennas and equipment in the weapons bay. This radome is about 16 feet long, 1½ feet wide, and about 1 foot deep. It gives a very low profile in appearance.

Senator GOLDWATER. Where are you flying that?

Colonel MCKENNA. At the Grumman Calverton facility at the eastern end of Long Island. We will fly it on this aircraft through the end of April. Aircraft No. 2 goes in the air the first part of May, and then after some tests at the Grumman radar range, we go to Eglin Air Force Base in October, then out to Mountain Home and Nellis Air Force Base in the winter of 1977 and the spring of 1978.

Quite an aggressive flight test program is now planned.

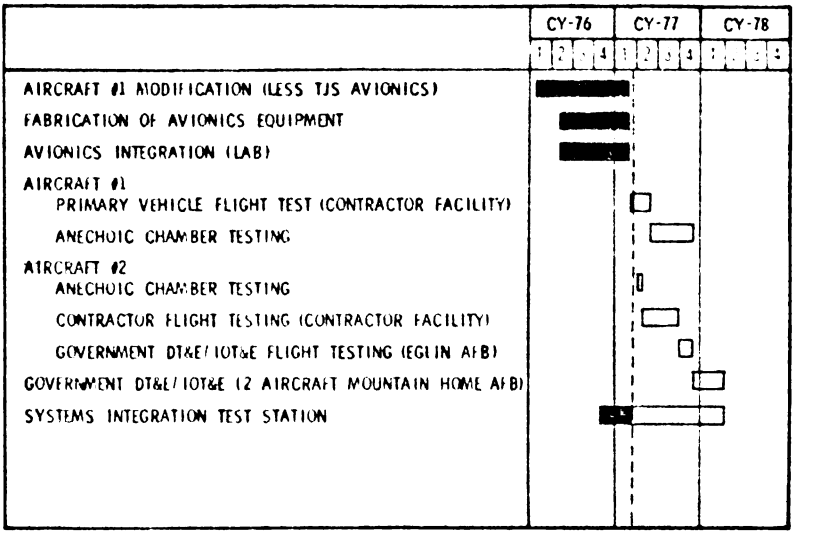
Senator GOLDWATER. That is a go to hell paint job.

Colonel MCKENNA. In our first flight test series we had the standard camouflage job on the F–111, and the chase crew had a very hard time finding the aircraft, so we had the aircraft painted white for better recognition, and we put a few stripes on the side.

Digitized by Google

EF-111A TACTICAL JAMMING SYSTEM

EF-111A RDT&E SCHEDULE


CY-76
CY-77
CY-78
1 2 3 4 1 2 3 4 1 2 3 4
AIRCRAFT #1 MODIFICATION (LESS TJS AVIONICS)
FABRICATION OF AVIONICS EQUIPMENT
AVIONICS INTEGRATION (LAB)
AIRCRAFT #1
PRIMARY VEHICLE FLIGHT TEST (CONTRACTOR FACILITY)
ANECHOIC CHAMBER TESTING
AIRCRAFT #2
ANECHOIC CHAMBER TESTING
CONTRACTOR FLIGHT TESTING (CONTRACTOR FACILITY)
GOVERNMENT DT&E/IOT&E FLIGHT TESTING (EGLIN AFB)
GOVERNMENT DT&E/IOT&E (2 AIRCRAFT MOUNTAIN HOME AFB)
SYSTEMS INTEGRATION TEST STATION

This is our R. & D. test schedule, sir. I pretty much mentioned that we are in the flight testing now. This line is where we are today.

Aircraft No. 2 will get a quick test in the anechoic chamber, which is a one of a kind facility. It is the only place we can hang an aircraft the size of the F-111, close the doors, and radiate all of the systems such as the jammers and the onboard avionics to make sure that we do not have a flight safety problem with all of the high power that is generated.

We will complete that test at Eglin in November, and we will finish our R. & D. program in March of 1978.

We have along with this a test station at Grumman where we are doing human factors, crew training, and software evaluation of the entire weapon system's ability to do its jamming job.

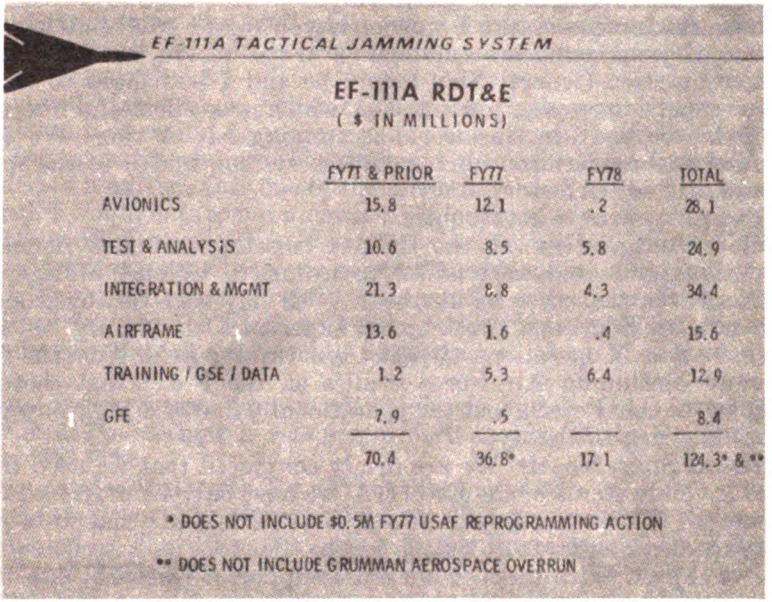
This is a photograph of the systems integration facility at Grumman. We are again using EA-6B equipment, which is in an adjacent room. We have added on our EF-111A cockpit, which is this photograph, and this is a replica of what is actually in the aircraft with the display the operator has in front of him. It contains the switches and controls to activate the system.

On this side is a newly developed software manned integration panel where the engineer sits here, and his technicians can then change commands to this patchboard, computer keyboard and display to keep changing commands to the operator for training.

Behind that, is the pallet that goes in the aircraft, the actual wiring harnesses. This is the top of it, five exciters and the computer here, and underneath go the 10 jammers. The receivers, they go in the tip on the top of the tail, on the same lash-ups here. We have a threat simulator for the ECM environment in this complex that plays in actual threat signals to the receivers, and they get this played on the scope and the operator then gets commands to jam it.

Digitized by Google

This will stay in operation for the life of the program. So again, if we have changes to make, we do it in real time.



This is our R.D.T. & E. estimate for the program. In 1977 the estimate was $116.9 million. This estimate has increased to $124.8 million or up by $7.9 million. The breakout for the added $7.9 million is as follows: $0.8 million for improved ALQ–99 transmitter reliability, $400,000 for test analyses, $6.2 million for ground support equipment and since the submission for the fiscal year 1978 FYDP, $0.5 million has been reprogramed in fiscal year 1977 through internal Air Force sources for software and hardware changes as a result of ECP's being incorporated on the Government furnished terminal threat warning subsystem.

In fiscal year 1978 we are requesting $17.1 million to complete the R.D.T. & E. program. The majority of these funds will be used to pay for ground and flight testing and relevant analyses, integration and management, training, data and for development of peculiar electronic support equipment. I will provide examples of our plans to expend the fiscal year 1978 funds in the three principal areas:

Test and analysis, a large portion of the $5.8 million identified for test and analysis is for the completion of anechoic chamber testing, system integration testing, development and testing of system software and sustaining engineering for support of Government flight testing. Also included are funds for Government test support centers such as Armament Development Test Center and the Air Force Test and Evaluation Center for the Government flight test program.

Digitized by Google

AIR FORCE SUPPORT FOR EF-111

Senator GOLDWATER. Colonel, I hate to do this, but General Slay has to leave at 10 to be at another hearing.

I have the same problem. I wonder if you would mind putting the balance of your comments and figures in the record, because I did want to question General Slay before he and I both have to leave. It is no aspersion on your presentation, which is excellent and interesting, but everybody in this world is running out of time. We just modified and modernized our committee system, and it is the most screwed up thing in history.

You think you have got troubles.

Before you go, General, the EF-111 is being evaluated in many simulations and analysis studies, according to Colonel McKenna's statement. On the other hand, the EA-6B has been deployed since 1971 and saw Southeast Asia combat experience in 1972 and 1973 in the linebacker II operations. General, is it valid to infer from the fact of many continuing Air Force studies on the F-111 that there is doubt in the Air Force about the operational value of a high-powered jamming system of that type?

General SLAY. No, sir. We are firmly convinced that we need that, Senator Goldwater. For the EF-111A, we have only 42 airframes that we can use. We have estimates of as many as [deleted] that we would really require in order to do the job for the [deleted] daily strike sorties that we expect. With these 42 we could support a [deleted] day war. If we meter them out at [deleted] per day of jamming support, we can protect something under [deleted] sorties during that [deleted] period. That is not enough, and we are investigating other means of overcoming this jointly with the Navy.

I have been working with Bob Mandeville looking at perhaps even buying EA-6B's in the 1979-80 timeframe, but we are just exploring right now.

AIR FORCE EXPERIENCE WITH EA-6B

Senator GOLDWATER. Has the EA-6B participated in Air Force operational exercises, and if so, did that give you any evaluation of its effectiveness?

General SLAY. Yes, sir, it has. It has participated in several. It has participated with our AWACS and it has participated in several tactical exercises. The experience coincides with my previous statement, that it is a first-class system. We have seen nothing in those tests that would lead us to a total system that did not have a standoff jammer, and we also are planning on using, as you know, the EF-111A in a penetrating mode as escort.

Senator GOLDWATER. You used them in Red Flag, didn't you?

General SLAY. Yes, sir; we did.

Senator GOLDWATER. It worked out all right?

General SLAY. Yes, sir; it did.

GAO REPORT ON EF-111

Senator GOLDWATER. The GAO has written a report on the EF-111 which recommends that the production program not be started until all

Digitized by Google

of the present known, as they say, deficiencies are corrected. On the other other hand, all of those so-called deficiencies exist today in the EA–6B. Admiral Mandeville, how do you feel about the EA–6B, should production stop on it until every shortcoming is fixed, or does Navy experience tell you that the present system is highly effective even as it exists today?

Admiral MANDEVILLE. Senator Goldwater, I guess my quickest way to answer that would be to go right to our communications with the fleet commanders who use the systems. I think Commander McDivitt alluded to it earlier. It is one of the airplanes they feel they must have aboard. I would hate to put anyone in the position of saying how would you trade off, because we can't do that with a wing, but it is one of the primary aircraft, and was—in a support airplane, this is kind of unusual. Their feeling out there, we have a lot of message traffic from the 6th Fleet and the 7th Fleet, and their feeling that the airplane is extremely effective and extremely important to them in many, many aspects.

Senator GOLDWATER. Commander McDivitt, did the GAO investigate the EA–6B to see how it was performing as part of their evaluation of the EF–111?

Commander MCDIVITT. No, sir, not that I am aware of.

Senator GOLDWATER. General Slay, would you provide for the record a summary of EA–6B participation in Air Force operations and test programs? I think there is one available.

General SLAY. Yes, sir, there is one available, and we will put that in the record. I don't have it with me today, but we will put it in the record.

[The information follows:]

In 1970–71, the Air Force participated in, and reported on, testing of baseline operational and preproduction versions of the EA–6B. From July 1972 through January 1973, EA–6B flew combat support missions in Southeast Asia. Since 1972, the EA–6B has participated in many operational/joint tests and exercises which the Air Force either conducted or participated in. Listed below are the operations/tests which included EA–6B participation.

DATE, PURPOSE, AND SORTIES

A. AIR FORCE/JOINT TESTS

September 1970: ADTC Effectiveness Tests of EA–6B, None.
October 1971: Operational Evaluation of EA–6B Weapon System, 4.
January-November 1972: Support AWACS D. T. & E., 20.
March–October 1974: Support AWACS D.T. & E. 56.
July 30–December 22, 1976: Support AWACS I.O.T. & E., 31.
October–November 1974: Support Joint Navy/Air Force Electronic Warfare Joint Test (EWJT), 54.

B. COMBAT SUPPORT

November 10, 1972–January 27, 1973: Combat ECM Support, 114.

C. RED FLAG EXERCISES

May 1976: Red Flag V ECM Support, 8.
June–July 1976: Red Flag VI ECM Support, 2.
October 1976: Red Flag VIII ECM Support, 22.
October 1976: Red Flag 77–1 ECM Support, 8.
January–February 1977: Red Flag 77–3 ECM Support, 19.

Digitized by Google

D. OTHER EXERCISES

February 21, 1973 : Amalgam Arrow 73–5, 2.
May 23, 1973 : Amalgam Arrow 73–7, 2 .
May 30, 1973 : Falling Brave 73–4, 2.
July 11, 1973 : Snowtime 74–1, 3.
November 19, 1973 : Felix Keynote 74–6, 2.
February 6, 1974 : Amalgam Arrow 74–5, 2.
March 9, 1975 : Snowtime 75–5, 2.
July 15, 1975 : Falling Brave 76–1, 2.
September 25, 1975 : 25th NORAD Exercise, 2.
October 8, 1975 : 25th NORAD Exercise, 2.
October 16, 1975 : Amalgam Mute 76–3, 2.
October 24–29, 1975 : Brave Shield VIII, 10.
November 20, 1975 : Vigilant Overview 76–2, 2.
January 22, 1976 : Felix Keynote 76–4, 2.
February 5–17, 1976 : Bold Eagle 76, 38.
March 2, 1976 : Feudal Keynote 77–2, 2.
March 18, 1976 : Felix Brave 76–02, 2.
May 21, 1976 : Vigilant Overview 76–4, 2.
August 19, 1976 : Vigilant Overview 76–03, 2.
December 8, 1976 : Vigilant Overview 77–1, 2.

Quantitative data does not exist for all activities listed above. In particular, data regarding results of excercises, if any exists at all, is in the form of very general or operator-to-operator comments. The following reference documents contain analysis/comments of EA–6B participation and effectiveness.

TITLE AND DATE

a. HQ TAC/TAWC Final Report, EA–6B Operational Evaluation, October 1971.
b. Tech Report ADTC TR–70–229, February 1976.
c. Electronic Warfare Joint Test, Final Report (Annex A and B), February 1976.
d. Red Flag V Final Report, July 1976.
e. Red Flag VI Final Report, August 31, 1976.
f. Red Flag VIII Final Report, November 29, 1976.
g. Red Flag 77–1 Final Report, December 15, 1976.
h. Air Force Special Communications Center, Comfy Coat Reports :
Comfy Boy 12–72, July 1972.
Comfy Boy 15–72, August 1972.
Comfy Boy 19–72, November 1972.
Comfy Coat EB6–73 (Combat Effectiveness), November 1973.

NUMBER OF EF–111'S REQUIRED

Senator GOLDWATER. And General, one criticism the GAO made was that the Air Force's DCP force structure requirement was for [deleted] EF–111's, but only 42 F–111's were available for modification. Is that correct ?

General SLAY. That is correct.

Senator GOLDWATER. And if so, what will the Air Force do about it?

General SLAY. Well, we have what we consider a constrained force objective of [deleted] which we cannot reach, and that would only provide us [deleted] hours per day for a [deleted]-day period. It is quite obvious that we do need more support.

Senator GOLDWATER. You need the full [deleted].

General SLAY. Well, sir, whether we need the full [deleted] or not is a judgment factor. It would not at all surprise me that that is the figure, or a figure approaching that.

Digitized by Google

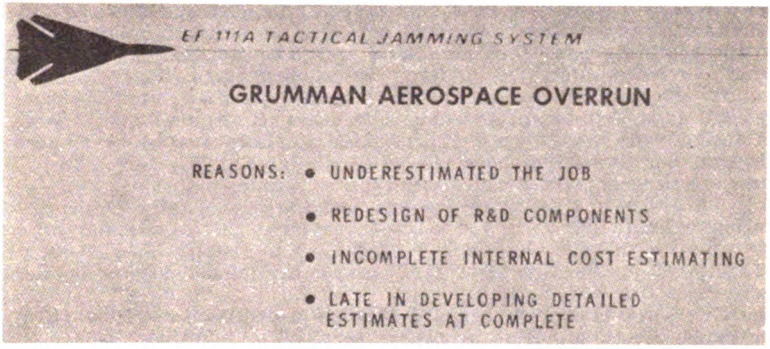
Senator GOLDWATER. General, I think you had better get on your horse.

General SLAY. Thank you, sir.

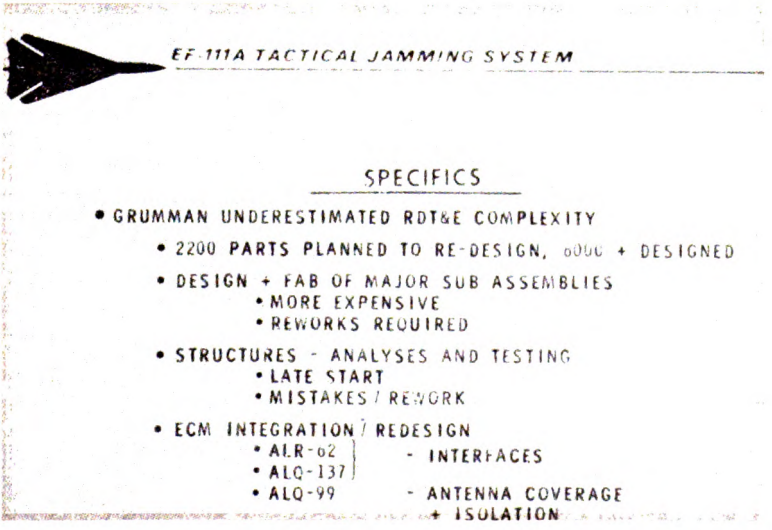
Senator GOLDWATER. Thank you very much, for being here.

[General Slay departed; Major General Ahern replaced him.]

[The prepared statement of Colonel McKenna follows:]


EF 111A TACTICAL JAMMING SYSTEM
GRUMMAN AEROSPACE OVERRUN
REASONS:
• UNDERESTIMATED THE JOB
• REDESIGN OF R&D COMPONENTS
• INCOMPLETE INTERNAL COST ESTIMATING
• LATE IN DEVELOPING DETAILED ESTIMATES AT COMPLETE

In addition to the funds requested in fiscal year 1978 to conclude the R.D.T. & E. program, we have a cost overrun by the Grumman Aerospace Corporation. Air Force analyses of the cost information provided us by the Grumman Aerospace Corporation has revealed that over the past several months additional costs were incurred by the corporation to complete the design and fabrication and to prepare the two prototype aircraft for flight testing. The information on this chart describes in overview the difficulties the corporation has experienced. Basically Grumman Aerospace Corporation underestimated the magnitude and complexity of the development program. Redesign of components and incomplete internal cost estimating have resulted in optimistic projections for the cost at completion.


EF-111A TACTICAL JAMMING SYSTEM
SPECIFICS
• GRUMMAN UNDERESTIMATED RDT&E COMPLEXITY
• 2200 PARTS PLANNED TO RE-DESIGN, 6000 + DESIGNED
• DESIGN + FAB OF MAJOR SUB ASSEMBLIES
• MORE EXPENSIVE
• REWORKS REQUIRED
• STRUCTURES - ANALYSES AND TESTING
• LATE START
• MISTAKES / REWORK
• ECM INTEGRATION / REDESIGN
• ALR-62 } - INTERFACES
• ALQ-137 }
• ALQ-99 - ANTENNA COVERAGE
+ ISOLATION

Specifically, the redesign efforts which occurred have resulted in an increase in the number of piece parts required to be manufactured to support the new designs. As one example, during redesign of the engine nacelle side doors, approxi-

Digitized by Google

mately 500 new detail parts were required to be manufactured. Overall in the R.D.T. & E. phase, the number of piece parts has increased from 2,200 to over 6,000.

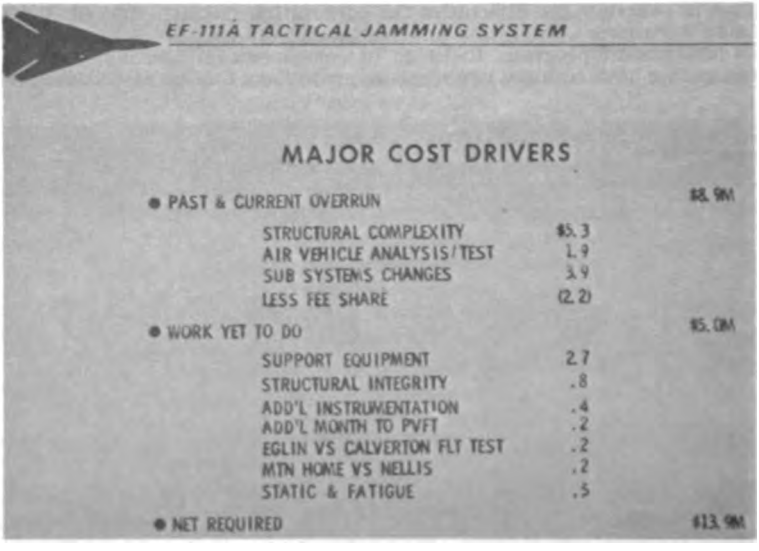
With regard to design of major subassemblies, the weapons bay pallet was originally envisioned as a simple structure using similar fittings in multiple locations; however, because of the size of the line replaceable units (LRU's) the complexities of the electrical harnesses, liquid cooling and air duct routing, virtually all the fittings were unique. In addition, the Pallet hoist was proposed to be an off-the-shelf electrical motor and cable drive similar to ones used on cargo aircraft. Because of personnel safety and earlier unknown structural requirements, the existing hoist could not meet the design requirements. A new hoist incorporating a fail-safe mechanism had to be designed and developed.

Many problems were encountered interfacing with the existing F–111 structure, the original aircraft design rationale, loads and analysis techniques were unclear to Grumman personnel. For example, Grumman established EF–111A design loads based upon F–111 interface constraints rather than anticipated loads and therefore de-emphasized the loads analysis. This forced them into a reverse engineering process which was time consuming and costly.

Both hardware and software problems have been encountered during the integration/redesign effort on the ALR–62 terminal threat warning subsystem. Basic software deficiencies had to be corrected to enable the ALR–62 to pass the functional qualification test (FQT) and hardware deficiencies have delayed acceptance testing and delivery.

The EF–111A version of the ALQ–137 self-protection subsystem (SPS) has encountered design problems in system sensitivity. Additional design was required to provide the required threat signal sensitivity and to remedy a situation were interference from the jamming subsystem (JSS) could cause desensitization of the SPS through the adaptive threshold circuitry.

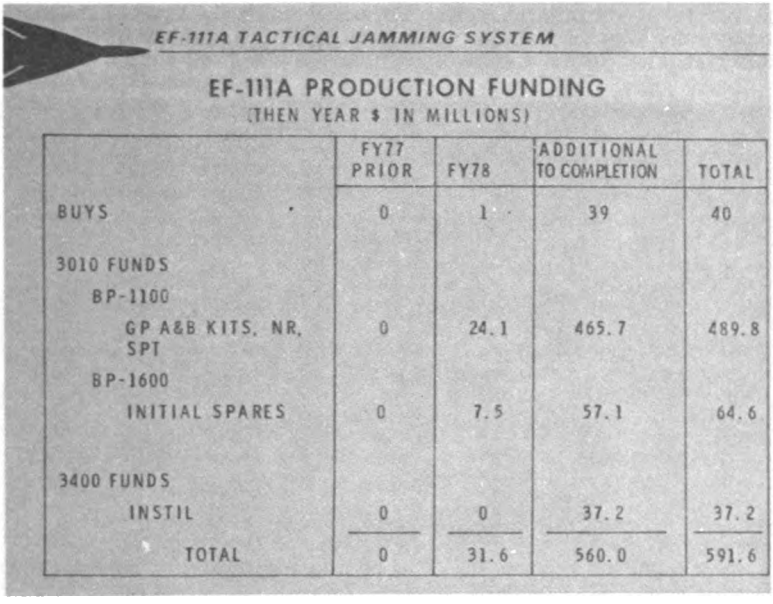
The band 5/6 receiver antennas required redesign and additional pattern measurements. Additionally, a redesign effort was required to obtain the necessary antenna isolation in the fin cap installation.



The financial size of the overrun problem is $13.9M. This amount constitutes a present and past overrun of $8.9M and an added $5.0M for work yet to be done through fiscal year 1978. This chart summarizes the areas where this money has been spent and will be spent to allow Grumman Aerospace Corporation to meet performance aspects of their contract and to allow the R. & D. program to continue on schedule.

The Air Force is currently addressing possible solutions for the overrun.

Digitized by Google



EF-111A TACTICAL JAMMING SYSTEM

EF-111A PRODUCTION FUNDING
(THEN YEAR $ IN MILLIONS)

	FY77 PRIOR	FY78	ADDITIONAL TO COMPLETION	TOTAL
BUYS	0	1	39	40
3010 FUNDS				
BP-1100				
GP A&B KITS, NR, SPT	0	24.1	465.7	489.8
BP-1600				
INITIAL SPARES	0	7.5	57.1	64.6
3400 FUNDS				
INSTIL	0	0	37.2	37.2
TOTAL	0	31.6	560.0	591.6

In fiscal year 1978 the Air Force plans to initiate the production phase of the EF–111A program. $31.6 million is requested to begin this effort. This chart outlines our current estimate of funds required by fiscal year to modify 40 additional F–111A's into EF–111A tactical jamming system.

The BP–1100 funds (group A and group B kits, non-recurring, and support costs) are based on a buy plan of 1 system in fiscal year 1978, 12 in fiscal year 1979, 24 in fiscal year 1980, and 3 in fiscal year 1981. We plan to combine, via options, the buys in fiscal year 1978 and 1979 to get the economies of a larger order. The program should proceed in fiscal year 1978 in order to maintain continuity with the end of the R.D. & E. phase so that the trained and experienced employees in industry can be retained. In fiscal year 1978 of the $24.1 million requested in this area, $12.0 million is for procurement of this initial group A and B system. $0.9 is for support equipment purchases, and $11.2M is for non-recurring and production tooling expenses necessary to prepare industry for the production program.

Since the present EA–6B aircraft production schedule continues through February 1982, the shutdown of production lines for the exciters and transmitters will occur in December 1977 and May 1978 respectively. Companies which supply components for the exciter and transmitters have begun or have completed the phase out of their production facilities.

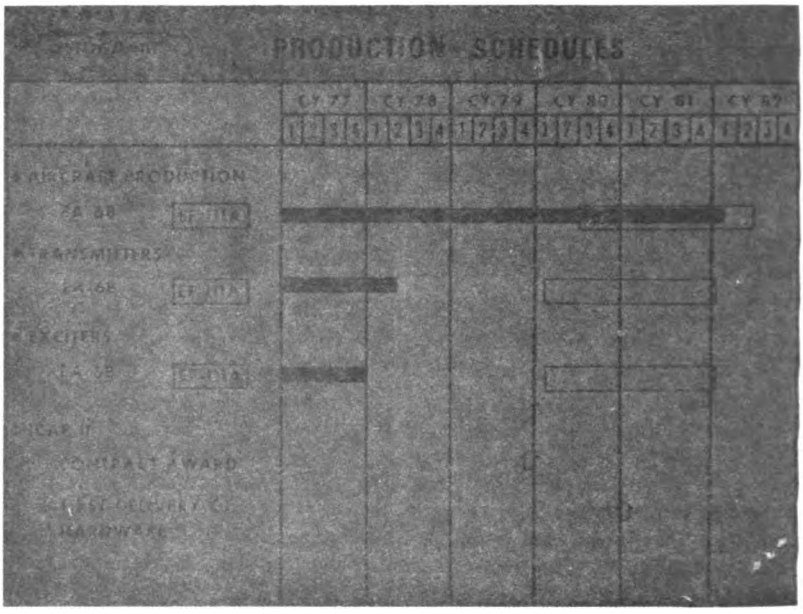
The 40 EF–111A aircraft production program contract is planned for July 1978. Although there is an overlapping of the aircraft deliveries this overlay vividly highlights the loss of production capabilities of 26 and 21 months for the exciters and transmitter production facilities. Money, for start-up will be required and are included in the $11.2M identified as non-recurring costs in the fiscal year 1978 production budgets.

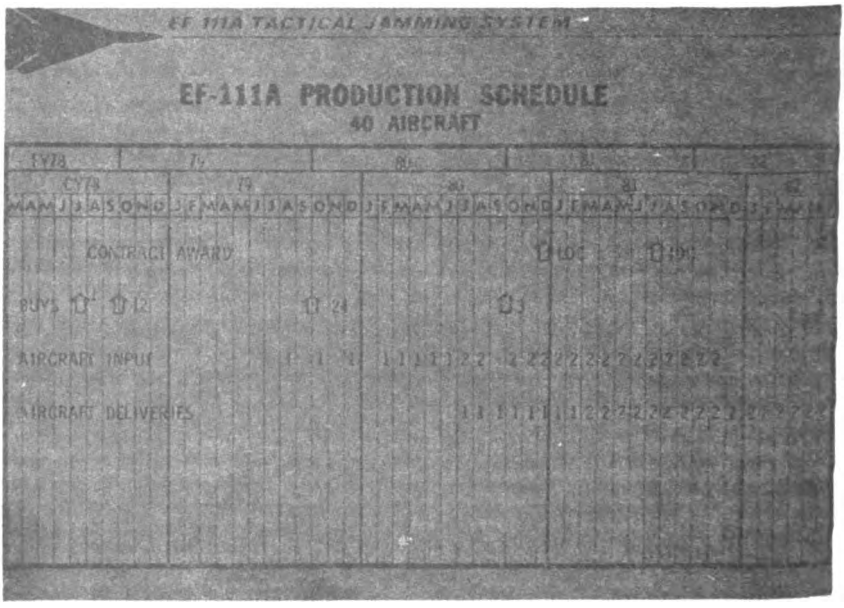
Should the Navy ICAP II program receive a production go-ahead in fiscal year 1979, there would be a significant savings to the Navy in the nonrecurring start-up costs for those subcontracts efforts in the transmitter and exciter areas. The ICAP production program could then be smoothly phased into the EF–111A TJS production efforts.

The BP–1600 line (initial spares) is based on the group A and B system procurements and equipment support costs, and the number of aircraft deliveries in the first two delivery years. The $7.5 million requested in fiscal year 1978 will procure those spares to support the first three aircraft.

Digitized by Google

The 3400 funds (installation costs) are estimated on the basis of the aircraft input schedule. There are no installation charges in fiscal year 1978 since the first aircraft input does not occur until August 1979.





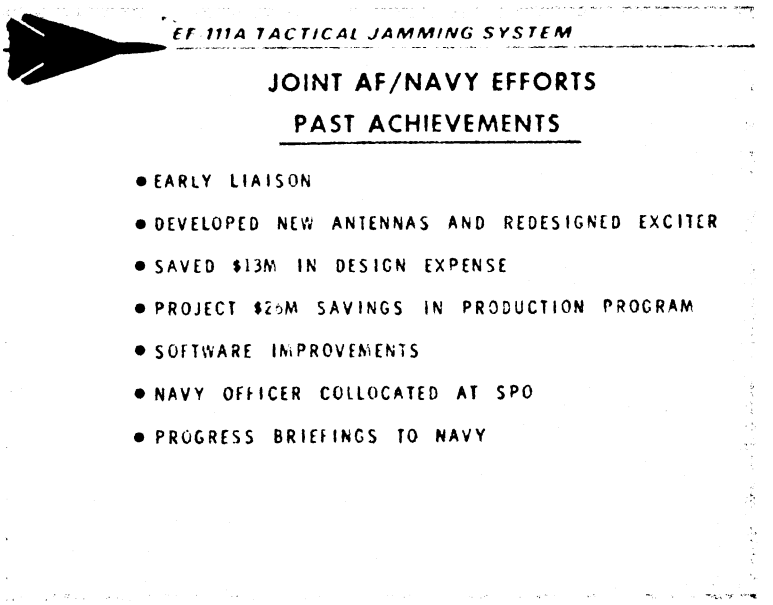
The production/modification schedule assumes a contract award in July 1978. First aircraft input will be in August 1979 and the last two will input in November 1981.

Digitized by Google

Aircraft deliveries will begin in July 1980. IOC of 18UE aircraft would be in July 1981 with the final delivery of the 40th aircraft in June of 1982. The two prototypes will be processed through the production facility to update their configuration similarly to the 40.

This schedule will satisfy the force structure requirements of one 18UE aircraft squadron in fiscal year 1981 and the complete delivery of a total of two 18UE aircraft squadrons in fiscal year 1982.

Requests by the operational theater commanders to provide an ECM capability to the tactical forces at the earliest date possible has resulted in direction by the Secretary of the Air Force to investigate the possibility of a limited operational capability (LOC). This capability can be achieved [deleted]. These weapon systems can be ready for contingency deployment to the operational commands.


EF 111A TACTICAL JAMMING SYSTEM
JOINT AF/NAVY EFFORTS
PAST ACHIEVEMENTS
• EARLY LIAISON
• DEVELOPED NEW ANTENNAS AND REDESIGNED EXCITER
• SAVED $13M IN DESIGN EXPENSE
• PROJECT $26M SAVINGS IN PRODUCTION PROGRAM
• SOFTWARE IMPROVEMENTS
• NAVY OFFICER COLLOCATED AT SPO
• PROGRESS BRIEFINGS TO NAVY

The EF–111A program has benefited since its inception in November 1971 by outstanding cooperation from the Department of Navy. At that time, one of my first efforts as program director was to establish a liaison with the Navy by requesting they share with us the knowledge they were acquiring with the development and employment of the EA–6B. This information exchange has continued through the 5-year life of the EF–111A program.

Specifically, thanks to their assistance, we have newly developed antennas, a redesigned exciter which is the heart of the ALQ–99 system, and have developed a different philosophy covering the design and manufacture of mechanical and electronic support equipment.

These efforts have allowed us to avoid approximately $13M in design expense, and will conserve approximately $26M in the production program through our method of developing and producing support equipment alone.

Our software for the onboard computer continues to pass design points in excellent shape because of the Navy assistance.

Approximately one year ago, I requested the Department of Navy to assign a Navy officer with electronic warfare and maintenance experience to the EF–111A program office at Wright-Patterson Air Force Base. This request was approved. We now have for a 2-year period, a Navy officer aboard to continue this liaison on a daily basis.

We have visited the Navy periodically to keep them aware of our development and changes on the ALQ–99 system. Our most recent visit to Whidbey Island Naval Air Station was on 27–28 Jan. 77. We provided Admiral Harris and his staff with test results of the new EF–111A Exciter, new antenna patterns and other engineering improvements active on our program so they could consider these changes for incorporation into their ICAP II program. The continuation of these joint efforts have resulted in financial savings for the Air Force. We have better designed and improved hardware which we are now able to share with them for future advancements to the EA–6B.

Digitized by Google

EF-111A TACTICAL JAMMING SYSTEM

JOINT AF/NAVY EFFORTS

FUTURE PLANS

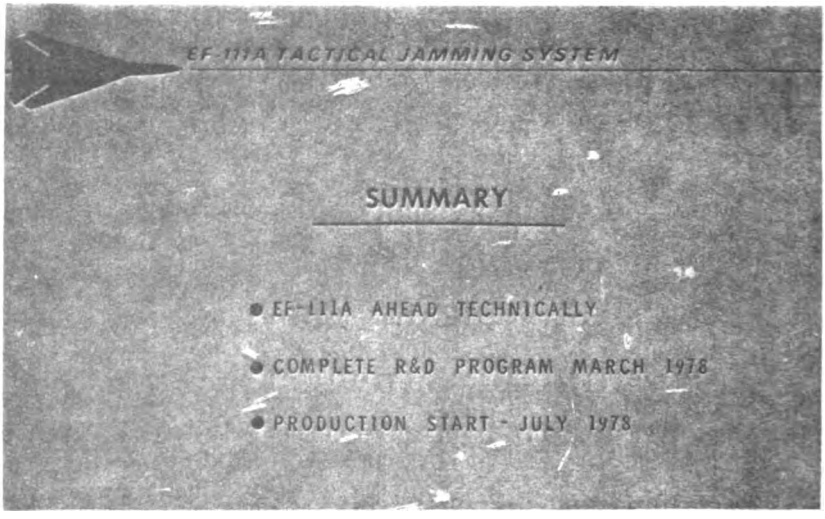
- ADVANCING BAND [deleted] TECHNOLOGY
- TWT AND BAND 7 IMPROVEMENT
- DEVELOPMENT OF ADVANCED POWER MANAGEMENT SYSTEM (APMS)

Beyond the everyday and mutual sharing, the Navy and Air Force are cooperating on future electronic countermeasure improvements in these two weapon systems in three specific areas.

First, band [deleted] technology—we are attempting to increase our radar jamming effectiveness [deleted] with the same techniques and power currently available for [deleted] and below.

In Band 7—we have broadened the frequency range and improved the power supply to the traveling wave tube, thereby increasing efficiency and threat coverage. This project now involves NASA as well as the Navy and the Air Force. It is competitively stimulating industry to create a better design. We have found ways to improve reliability of the expensive traveling wave tubes (TWT's) that are essential to the ALQ-99 transmitter.

Lastly, the Air Force avionics laboratory is presently developing an advanced power management system. This system, through computer management of all jamming resources, will attempt to maximize effectiveness against threat radars with an improved efficiency in management of the jamming aircraft's resources.


EF-111A TACTICAL JAMMING SYSTEM
SUMMARY
• EF-111A AHEAD TECHNICALLY
• COMPLETE R&D PROGRAM MARCH 1978
• PRODUCTION START - JULY 1978

At present the EF-111A is technically ahead of its envisioned achievements. Plans are to complete the R. & D. in March 1978 after a combined development test evaluation (D.T. & E.) and initial operating test and evaluation (I.O.T. & E.).

We plan to present our findings to the Secretary of Defense via the Defense Systems Acquisition Review Council (DSARC) process in the spring of 1978. With his support, we will proceed with the production program in July 1978 as briefed to you earlier in this testimony. If there are any questions we will be pleased to answer them.

Digitized by Google

Senator GOLDWATER. Colonel, I was going to ask you some questions, but gentlemen, I have to apologize for leaving you. I have got three other meetings going, none as important as this, but the Democrats leave before we do. [General laughter.]

EF-111 OVERRUN

Mr. CROMWELL. Colonel, when did you first learn of the overrun on the EF-111 program?

Colonel MCKENNA. We first began to get suspicions of the overrun in November of 1975 by analysis of the cost records and information reports from the Grumman Aerospace Corp.

Mr. CROMWELL. Did you mean 1975?

Colonel MCKENNA. 1975.

Mr. CROMWELL. Why wasn't the overrun reflected in the fiscal year 1978 budget submitted to Congress?

Colonel MCKENNA. The analysis and collection of the hard data to substantiate factually the size of the overrun was not obtained by us until after the fiscal year 1978 submission. We concluded our very detailed analysis of the Grumman Aerospace Corp.'s financial problem between December 13, 1976, and March 4, 1977.

Mr. CROMWELL. That is over a year later.

Colonel MCKENNA. Yes, sir. In the interim between the first concern we had of the overrun in late 1975, we continued to press the Grumman Aerospace Corp. for detailed data and their own internal awareness and acknowledgment that an overrun was actually there. The information began to show up in the September 1976 cost performance reports. We reported a $2.1 million overrun to the Air Force at my quarterly review in November of 1976. At that time the information we had from the Grumman Corp. indicated that amount could be accommodated in our current request for fiscal year 1978 funds. But in subsequent months, more information became available to us which indicated that the overrun was of a much larger size and proportion and we then, as I mentioned earlier, went through a much more detailed analysis and found that the overrun of the R. & D. program and cost of completion through March of 1978 is on the magnitude of about $14 million.

Mr. CROMWELL. When you testified last year to the committee, did you say there were any indications of financial problems?

Colonel MCKENNA. No, sir, I did not. Again the indications we had were refuted by the Grumman Corp. on our first formal attempts to get cost tracking account information from them, and my letter to them in November 1975. Their answer said in very clear terms that there would be an underrun to the R. & D. contract.

So they did not recognize their internal cost flow problems at that point. It wasn't until, as I mentioned, September 1976 that the corporation began to get the information internally that said substantially here was going to be and they were in an overrun position. But still at that time the details were not available. We went between April 1976 and November 1976, three additional times to the corporation. The letters did not acknowledge the fact—we asked in those communications that they give us the details, give us a reorganization

86-379 O - 77 - 14

Digitized by Google

plan in case they acknowledged the fact that the overruns were there, and show us corrective actions to minimize the effect of that.

Additionally, we brought the Grumman management and control personnel to Wright Patterson Air Force Base where our project office is, and explained to them in detail our analyses of their cost information which, on the trends of manpower expenditures and manning and efficiency factors, indicated the overrun was there.

The corporation personnel did not accept our analyses and findings and did not give us the information. So in the fall of this year, when more data became available to us as a result of our internal scrubbing with the corporation's accounts, we began to extract the details. And in this brief period of time between December and March, we have had two financial audits of the corporation's cost information, and we have concluded separately and together the size of the overrun of about $14 million. That is the amount to finish the R. & D. program.

Mr. CROMWELL. It sounds to me, from what you are saying, that the Air Force's ability to track the financial status of the program was better than the contractor's. What is your assessment?

Colonel MCKENNA. Well, in directing the analyses and the forecasting that there is or would be an overrun, yes, sir. The things we were missing, and kept pressure on the corporation to provide to us, were the detailed expenditures, which were nonexistent until the fall of 1976.

Now, the reason the corporation could not develop those funds involved the amounts of money that they have had to spend to rework items, they changed quite a few of their designs to meet our contract terms. We have not changed the contract scope. But they underestimated the complexity of getting the job done. They planned to fabricate 2,200 parts to make these 2 prototypes occur. They wound up by redesigning over 6,000 parts. Quite a few of those were reworks and were very expensive.

In the doing of those items, the work flowed through four or five independent work breakdown structures or identification packages of work. These items, like brackets and hinges and hoists, and a myriad of things, did not have separate identifiers in the new work package. So when the engineering, manufacturing or other personnel did work, the cost accounting flowed through too many packages, so the corporation did not have the internal data to pick up those things.

So every time we would say you are overrun from our analysis, agree or disagree; if you disagree, show us your figures, they did not and could not develop those detailed bits of information until the end of this year. We put a full team in there, 7 days a week over a long period of time, to force the information out by taking all their computer price runs, spreading them out and going through them item after item.

That is a lengthy answer to your question.

Mr. CROMWELL. Well, it is a good and detailed answer.

Would you supply us for the record a chronology that would show, step by step, your communications with them and their communications back, and how much of an overrun you had identified or were estimating at each step along the way?

Colonel MCKENNA. Yes, sir, I will.

Digitized by Google

[The information follows:]

The following is a chronology of EF-111A Program Office Contractor communications regarding the R.D.T. & E. overrun. Associated program office and Grumman estimates of the projected contract overrun are provided in parentheses.

(a) ASD/RWF ltr. 28 Nov 75, subject: Unacceptable Cost and Schedule Variances, EF-111A TJS Program, Contract F33657-75-C-0254, and Grumman's response dtd 5 Dec 75. (SPO concern that slight cost/schedule variances could lead to overrun condition; Grumman response estimated an underrun.)

(b) ASD/SD25 ltr. 14 Apr 76, Col James L. McKenna to Mr. Robert C. Miller, Vice President, Grumman, EW Programs and Mr. Miller's response dtd 16 Apr 76. (SPO estimate of $1.2M overrun; Grumman estimate of $480K underrun).

(c) ASD/SD25 ltr. 9 Sep 76, Col James L. McKenna to Mr. Robert C. Miller, Vice President, Grumman, EW Programs and Mr. Miller's responses 5 Oct 76 and 2 Nov 76. (SPO estimate of $3.2M overrun; Grumman estimate of $2.1M overrun).

(d) SD25 ltr. 17 Nov 76, subject: EF-111A Tactical Jamming System, Col. James L. McKenna to Mr. Robert C. Miller, Vice President, Grumman, EW Programs, and Mr. Miller's response dtd 1 Dec 76. (SPO estimate of $3.9M to $4.8M overrun; Grumman estimate of $2.1M overrun).

(e) Ltrs from Gen Sylvester, Commander of Aeronautical Systems Division, to Mr. Bierwirth, President of Grumman Aerospace, 14 Feb 77, and 9 Mar 77, and Mr. Bierwirth's 22 Feb 77 response to 14 Feb 77 letter. (SPO current estimate of $11.1M overrun; Grumman's last estimate is $8.6M.)

EF-111 FUNDING PROBLEMS

Mr. CROMWELL. Now, if you are $14 million short overall, it would appear that you are going to have a fiscal 1977 budget problem.

Are you going to run out of money early in fiscal 1977, and if so, what are you going to do about it?

Colonel MCKENNA. Yes, sir. The serious shortfall in the R. & D. program, to keep it on its current schedule of flight tests that occur in mid 1977, we will run out of funds by the end of June this year. We reprograming action. As of the moment we have not decided on that have apprised the various commands and the air staff of our problem. They are currently working the solutions to that. A recommendation has not come forward yet. I am sure they will keep you informed as it does develop.

Mr. CROMWELL. General Ahern?

General AHERN. Yes, sir. At the present time we are awaiting recommendations from the Systems Command which has undertaken a review of this problem, including identifying possible sources for a reprograming action. As of the moment we have not decided on that action, nor have we identified sources. It is an immediate problem, you are absolutely correct.

Mr. CROMWELL. Can we expect to see a reprograming in April or May then?

General AHERN. Yes, sir, you could.

Mr. CROMWELL. Of roughly how much money?

General AHERN. To take care of the 1977 problem, is on the order of——

Colonel MCKENNA. $11 million.

General AHERN. $11 million.

The exact magnitude is a problem. We will pin it down a little bit more precisely, but as of the moment, it appears to be on the order of $11 million.

Digitized by Google

[The information follows:]

Preliminary information from nearly completed separate Air Force and Grumman audits has increased our confidence that the amount of the fiscal year 1977 reprogramming request, should we determine it appropriate to seek one, would be approximately $11 to $12 million.

IMPACT ON PRODUCTION COST

Mr. CROMWELL. All right. If the number of redesigned parts in the airplane has gone up from 2,000 to 6,000, it would seem reasonable to expect that the cost of the modification program also must have gone up by a considerable amount.

Now, do your figures that you showed today reflect a reassessment, based on the changes Grumman is talking about, of the modification cost, or do you expect that those will go up?

Colonel MCKENNA. There will be an increase as a result of some of the redesign efforts. We are now assessing that. We are currently in negotiations with the Grumman Aerospace Corp. to get that figure. We will have that figure developed well before the submission of the fiscal year 1979 POM on May 9.

Mr. CROMWELL. But in summary, then, the figures you gave today look understated for the cost of the modification?

Colonel MCKENNA. Yes, sir, they do.

Now, if I could, the 6,000-plus parts that Grumman has had to design or redesign in the main involve not new or added work to make the thing fly or work. What they involve is principally their original design plans and objectives had to be redone. So what the 6,000 parts compared to the 2,000-plus, a heavy number of that are just things that had to be redesigned for the prototype aircraft.

So in the production program, that part that will eventually go through the ground and flight test program and be approved and specified, will be like the part that was originally envisioned. So, the magnitude of parts for the R. & D. program should not be considered to be a scalar alarm of a significant increase in production program. There will be an increase but not by a proportional amount.

Mr. CROMWELL. You mean parts were redesigned once and then found to be inadequate and redesigned a second time?

Colonel MCKENNA. Yes, that is correct.

CONTRACTOR FOR MODIFICATION PROGRAM

Mr. CROMWELL. Now, who is going to do the modification program? Does Grumman have a sole source position, or is there any way to obtain competition for that?

Colonel MCKENNA. We had planned throughout the program to have competition for the production program. In January of 1978, the Air Force will issue a request for proposal to Grumman Corp. and to other interested aircraft modification firms, as well as getting data from the Sacramento Air Logistics Center of the Air Force Logistics Command to determine through that competitive process the best price, the best method of producing the 40 additional EF-111A planes.

Mr. CROMWELL. All right, thank you very much.

Colonel MCKENNA. Yes, sir.

Digitized by Google

General AHERN. Any further questions?

Mr. CROMWELL. Not from me.

General AHERN. In which case we will press on to the radar warning receivers presentation.

The first presentation is by Col. Kevin Gilroy, who is Chief of the Electronics Warfare Division, Directorate of Reconnaissance and Electronic Warfare, Air Force DC/S R. & D.

AIR FORCE RADAR WARNING REVIEW

Colonel GILROY. Good morning, gentlemen.

Our electronic warfare programs this morning will be briefed in two segments. The first segment will be the radar warning receiver programs. The second segment will be our active electronic countermeasures programs. The Navy portion of both briefings will be presented by Capt. Don Mathews.

OVERVIEW

PURPOSE/OBJECTIVE
INVENTORY
HISTORY
IMPROVEMENTS
RDT&E PROGRAM
SUMMARY

These are the various areas I will address in the briefing.

RADAR WARNING RECEIVERS

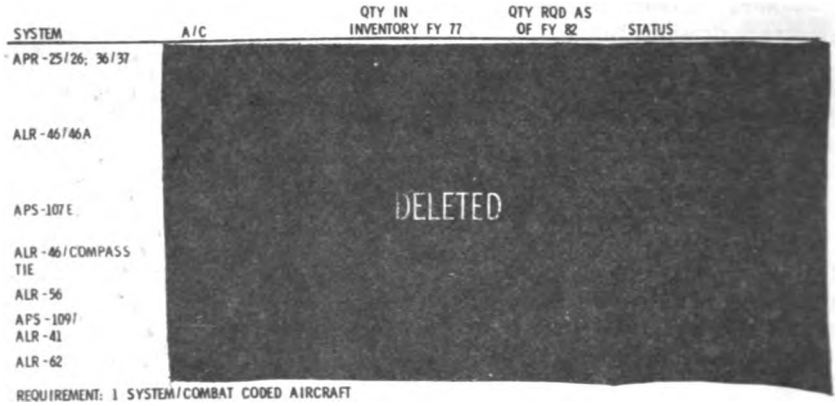
PURPOSE
TO PROVIDE AIRCREW WITH ACCURATE AND TIMELY WARNING AGAINST:
- SURFACE-AIR MISSILES
- AAA
- AIRBORNE INTERCEPTORS

OBJECTIVE
TO ENCHANCE AIRCRAFT SURVIVABILITY AND PENETRATION CAPABILITY
- TACTICS
- JAMMING/EXPENDABLES

Before I go into the individual radar warning receivers themselves, I would like to emphaize the importance of radar warning receivers to our tactical forces. The radar warning receivers are the primary means for real time detection and identification of the enemy's defensive systems. With accurate and timely warning, the aircrew can then decide whether to take evasive action, jam the radar associated with the defensive system, drop chaff, or use some combination of these actions.

Digitized by Google

USAF RADAR WARNING RECEIVER INVENTORY



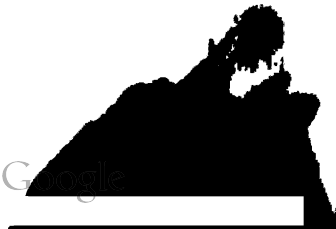
This chart provides an overview of the various radar warning receivers, their associated aircraft, and our force structure as we see it today.

I want to cover for you in greater detail the Air Force's three primary radar warning receivers: the ALR–46, ALR–56, and ALR–62.

First, there is the APR25/26 family, which has been updated to the ALR–46. The ALR–46 is used on all of our combat aircraft except the F–15 and the F–111. Since the ALR–46 represents our primary warning receiver, I will address its history and projected growth in more detail later. But as you can see from this graph, it is our intention to phase out the older radar warning receivers; the APR–25/26, APR–36/37 and APS–107E, which are of Southeast Asia vintage, and build up our inventory of ALR–46's and its update, Compass Tie.

The ALR–56 is the radar warning receiver which is currently in production for the F–15. The ALR–56 was developed for the F–15 because at that time there was no radar warning receiver suitable for installation on the F–15 which could effectively be used to control the ALQ–135 internal countermeasures system. Delivery of the ALR–56 radar warning receivers will catch up with aircraft deliveries [deleted] depending upon the F–15 production schedule. Our total requirement is [deleted] systems by fiscal year 1982.

The ALR–62 is an update to the APS–109/ALR–41 radar warning receiver on the F and FB–111 aircraft. The ALR–62 will also be installed on the EF–111A. The ALR–62 modification extended the frequency coverage of the APS–109 and replaced an analog analyzer with a digital processor to provide the capability we need to accommodate future changes in the threat. The digital processor used in the ALR–62 is a variant of the ALR–46 processor. Eventually we will update all APS–109's to ALR–62's. Prior to making this decision, we conducted an analysis to determine whether it was more cost effective to update

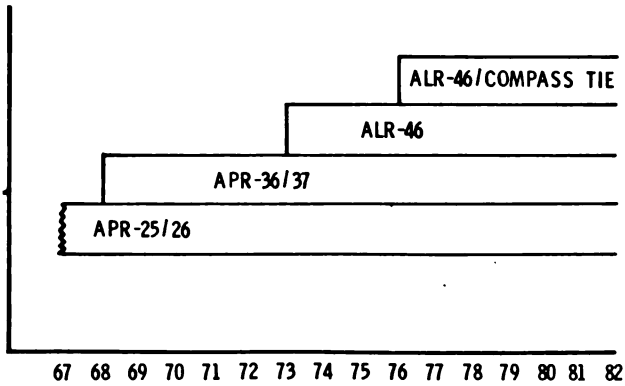


Digitized by Google

the APS–109/ALR–41 or to replace it with an existing system such as the ALR–46 or ALR–56. This analysis indicated that an update to the APS–109 would be best.

To give you a better understanding of why we were forced to improve our radar warning receivers, let me show you the capabilities of our older radar warning receivers and those of our more improved radar warning receivers against current threats. As you can see, the older receivers [deleted].

HISTORY
OF
ALR-46 RADAR WARNING RECEIVERS



In order to take care of the changing yet increasing number of threats, we have used the building block approach with the ALR–46. The predecessor to the ALR–46 was the APR–25/26, which was first introduced early in the Southeast Asia conflict.

RADAR WARNING RECEIVER
IMPROVEMENTS

APR 25/26 CHARACTERISTICS	APR 36/37 REQUIREMENT	METHOD OF ACCOMPLISHMENT
•ANALOG ANALYZER	[deleted]	PROCURED UPDATED ANALYZERS
•FREQ. COVERAGE [deleted]		PROCURED UPDATED PRE-AMPLIFIER
•STROBE DISPLAY		ADD THRESHOLD CONTROL PANEL

Digitized by Google

We updated the APR–25/26 to the APR 36/37 to provide an improved capability to accurately correlate [deleted] in order to display only the [deleted] the aircraft. Other features were also used to improve selectivity. These capabilities were then incorporated in production and the new system was nomenclatured the APR–36/37.

RADAR WARNING RECEIVER IMPROVEMENTS

APR-36/37	ALR-46	
CHARACTERISTICS	REQUIREMENT	METHOD OF ACCOMPLISHMENT
ANALOG ANALYZER	DIGITAL PROCESSOR	REPLACEMENT
PARTIAL FREQUENCY COVERAGE:	DELETED	MODIFY EXISTING PRE-AMPLIFIERS REPLACE ANTENNAS
DELETED		MODIFY EXISTING MISSILE WARNING RECEIVER
STROBE DISPLAY	ALPHA-NUMERIC DISPLAY	SOFTWARE IN DIGITIAL PROCESSOR

It soon became evident that the APR–36/37 would not be adequate. We were faced with Soviet radars covering the frequency spectrum from [deleted]. With a constantly changing threat, we had to go from our old hard-wired systems to ones which were software programable. We also had to improve our cockpit threat display to reduce crew saturation, while still providing positive threat indications. These and other changes updated the APR–36/37 to the ALR–46.

This chart shows the older model APR–36/37 with the strobe. The ALR–46 uses alpha numeric symbols, that is, an SA–3 shows up as a 3, airborne interceptors show up as an outline of a fighter. The older systems, the APR–25/26, the APR–36/37, the APS–107 and the APS–109 have strobes, while our newer systems have the newer capability: the 46 Compass Tie, the ALR–62, and the ALR–56.

I will show you what I mean. This is the same display we had on the APR–25 scope in Southeast Asia. It is very difficult for the crews to determine what type radar was scanning the aircraft. In this particular display we have an antiaircraft artillery associated radar here. Right over here, looking quite a bit the same are the two strobes of an SA–2 signal. A series of dots indicate a higher frequency SAM system, and the dashes indicate an airborne interceptor. You see, in a dense signal environment it is almost impossible to sort this out, especially in single-seat aircraft.

The updated display over here with the ALR–46, which is the type of display that we will have on the ALR–62 and the ALR–56 also uses alpha numerics, and when you have an SA–3, for instance, tracking the aircraft, it will be displayed on the scope as a 3, so there is no room for confusion. If there is a fighter, it will be displayed with

Digitized by Google

the symbol of a fighter. There is also other information available. The top priority signal has a diamond around the signal; if it has the missile guidance activity associated with it, it will have a circle around it, and if the missile is launched, the circle will blink.

RADAR WARNING RECEIVER IMPROVEMENTS

ALR-46 CHARACTERISTICS	ALR-46/COMPASS TIE REQUIREMENT	METHOD OF ACCOMPLISHMENT
DIGITAL PROCESSOR	IMPROVED DIGITAL PROCESSOR	REPLACEMENT
[deleted]	[deleted]	ADD FREQUENCY SELECTIVE RECEIVER SYSTEM (FSRS)
		REPLACEMENT
	POWER MANAGEMENT INTERFACE	PART OF FSRS

Our current and most improved radar warning receiver is the ALR–46/Compass Tie. The Compass update is designed to provide the ALR–46 with the capability to detect [deleted]. The second requirement is for obtaining direction of arrival information [deleted].

RADAR WARNING RECEIVER PROCUREMENT (3010)

($ IN MILLIONS)

	FY TQ PRIOR	FY 77	FY 78	FY 79	TO COMP
ALR-46/COMPASS TIE	34.9	8.9	52.3	67.9	100.5
ALR-56*	94.5	39.6	82.2	96.7	51.0
ALR-62/F-111	17.3	7.5	17.4	25.3	18.7

* COST IS TOTAL GROUP B COST OF F-15 TACTICAL ELECTRONIC WARFARE SYSTEM INCLUDING ALR-56, ALQ-135 AND ALQ-128

The procurement funding for the radar warning receiver systems is depicted here. The dollars shown for ALR–46/Compass Tie reflect total costs for the procurement and installation of a full-up ALR–46/Compass Tie in the F–4D, F–16, and A–10. For the F–16 and most of

Digitized by Google

the A–10's, the funding is included in the weapon systems procurement. The F–4D and approximately [deleted] A–10's will be retrofitted with Compass Tie. The ALR–56 costs are incorporated in the total costs of the F–15 tactical electronic warfare system, which also includes the ALQ–135 internal countermeasures systems and the ALQ–128 [deleted]. The ALR–62 cost reflect the class V modification funds required to update the tactical F–111 force.

Mr. CROMWELL. Now, that wasn't clear. Are you showing the total cost of the radar warning receiver program here, or are there additional costs under the F–16 and F–15 budgets that are not reflected here?

Colonel GILROY. These are total costs of the group B. The group A cost of the warning receivers is very difficult to break out. It is part of the aircraft design package, and it is very difficult to break out.

[Whereupon, Senator Thurmond entered the hearing room.]

Colonel GILROY. What I have here is the group B, the black boxes associated with each one of these with the exception of the ALR–56 portion here. Those figures include not only the ALR–56, but also the cost for the internal countermeasures system, and the cost for the [deleted].

Mr. CROMWELL. And for a simple definition for the record, group A is the wires and group B is the black boxes.

Colonel GILROY. Yes, that is basically correct.

The fiscal year 1977 funds were used to initiate ALR–46/Compass Tie for the F–4D, to procure long lead items for the ALR–46/Compass Tie installation in the F–16 and to continue the procurement of the ALR–46 for the A–10. Additionally, fiscal year 1977 funds were used to continue the procurement of the ALR–56 for the F–15 and also to continue with the class V modification for the installation of the ALR–62 in the F–111. Fiscal year 1978 funds will be used to continue the procurement of the ALR–56, the ALR–62 and the ALR–46/Compass Tie for the F–4D and F–16. The fiscal year 1978 funds also reflects the dollars required to incorporate the Compass Tie update in the A–10.

RADAR WARNING RECEIVERS
RDT&E 6.3/6.4 PROGRAMS

($ IN MILLIONS)

		FY 77	FY 78	FY 79
PE 64748F/64739F*	ALR-56 UPDATES	1.3	1.0	
PE 63718F	ADVANCED POWER MANAGEMENT	1.8	1.6	.07
	JAMMER COMPATABILITY	1.3	.5	.3

* PE 64748F WILL COMBINE WITH PE 64739F IN FY 78

Our research and development programs for the future are outlined here. In our 6.4 program elements, we will update the ALR–56 to provide the capability to obtain [deleted] similar to the way it was ac-

Digitized by Google

complished for the ALR–46/Compass Tie. Additionally, we plan to update the ALR–56 to be able to [deleted]. The bulk of our R. & D. effort is directed toward establishing a better technology base for our receiver systems. The advanced power management program uses the ALR–46 as a typical RWR system and is directed toward newer and more sophisticated radars [deleted].

Additionally, we have several efforts ongoing to develop a generic solution to radar warning receiver interference caused by jammers, both internal and pod.

JOINT USN/USAF
MEMORANDUM OF AGREEMENT
ON
RADAR WARNING RECEIVERS (RWR)

USN

ENSURE ALR-67 PROCESSOR IS FORM, FIT, FUNCTIONALLY RETROFITTABLE INTO ALR-45 AND ALR-46/COMPASS TIE

USAF

LEAD SERVICE FOR PRODUCT IMPROVEMENT ALR-45 & ALR-46/COMPASS TIE ANTENNAS AND PRE-AMPLIFIERS

LEAD DEVELOPMENT OF ADVANCED POWER MANAGEMENT TECHNIQUES

USAF/USN (JOINTLY)

PURSUE DEVELOPMENT OF NEW RECEIVER TECHNOLOGY

ESTABLISH A JOINT STATEMENT OF REQUIREMENTS FOR SUCCEEDING RWR SYSTEMS

Up to now I have addressed the radar warning receivers from an Air Force viewpoint. However, the Air Force and Navy have signed a memorandum of agreement to insure a collaborative effort between the two services for future radar warning receiver developments.

Specifically, the Navy has taken the lead in development of a new digital processor in their ALR–67 program which will be compatible with existing radar warning receivers.

The Air Force will take the lead in the product improvement area for inventory receivers and will place particular emphasis on the advanced power management techniques which we described in our previous R. & D. funding chart.

In addition to our individual responsibilities, the two services will jointly pursue the development of new receiver technology.

Finally, through the establishment of a joint statement of requirements, we will insure that any new radar warning receiver or any subsequent updates will have maximum commonality between the two services.

In summary, our planning concept is, first, to reduce the proliferation of radar warning receivers by standardizing on the ALR–46, 56, and 62. Second, improve these systems as required to detect new threats.

Digitized by Google

SUMMARY

STANDARDIZE ON CURRENT FAMILY ALRs, 46, 56, 62

IMPROVE STANDARD RECEIVERS AS REQUIRED

DEVELOP TECHNOLOGY FOR FUTURE GROWTH

Third, develop a strong technology base to provide the necessary growth required to handle the more complex and sophisticated threats of the future.

I will now turn the briefing over to Captain Matthews.

Mr. CROMWELL. I think Senator Thurmond has some questions he would like to ask on the EA–6B and the EF–111. I know the Air Force wanted to excuse its witnesses, but I think Admiral Mandeville and General Ahern can answer these.

BASIS FOR EA–6B FORCE LEVEL

Senator THURMOND. Explain for the subcommittee the basis for the Navy's position that a requirement for four EA–6B's to support each squadron is valid.

Admiral MANDEVILLE. I would like to supply that for the record, if I may.

[The information follows:]

Fleet operational commanders continually stress the need to operate four EA–6B aircraft from our carriers. This recommendation is based on lessons learned since the aircraft was first flown in combat in Southeast Asia, and includes the results from the many and varied exercises, evaluations and special studies and tests that have been conducted.

Electronic warfare support of our carrier-based strike forces during offensive operations against sea or land-based targets requires [deleted] aircraft to provide the optimum level of jamming effectiveness. EA–6B's are also assigned tasks to monitor the environment in an electronic surveillance role and to alert the task force of impending hostile activity. As an extension of the surveillance role, EA–6B's are assigned the task of jamming [deleted].

In any opposed tactical action in the future, EA–6B's would be required to carry out all these tasks [deleted]. Thus, a requirement for a minimum [deleted] is established. It must also be recognized that a less than unity material readiness condition will reduce the numbers of EA–6B aircraft that are available for any of these tasks. Under these conditions, the operational commander selects those tasks that are to receive priority support.

Senator THURMOND. Did the Navy request that four planes per squadron be approved during the budget preparation for fiscal year 1978?

Admiral MANDEVILLE. No, sir, we did not.

Senator THURMOND. What are the procurement alternatives referred to in your statement presented?

Admiral MANDEVILLE. The procurement alternatives?

Senator THURMOND. The procurement alternatives.

Digitized by Google

Admiral MANDEVILLE. I will get that for the record.

[The information follows:]

Three procurement alternatives are currently being examined. The first would propose to increase EA-6B procurement authorization by 16 aircraft with additional procurement in fiscal year 1981 through fiscal year 1983. The second alternative also proposes to increase authorization by 16 aircraft but adds the additional aircraft in fiscal year 1980 through fiscal year 1982. The third alternative proposes an increase of 33 aircraft in the years fiscal year 1980 through fiscal year 1983.

Senator THURMOND. What is the cost for the Marine support site program for their EA-6B's?

You can answer any of these for the record.

Admiral MANDEVILLE. For the record, yes, sir.

[The information follows:]

In fiscal year 1978 one complete USMC support site costs $16,032,000. Complete 3-site USMC support capability will cost $47,074,000.

Senator THURMOND. What is the per-aircraft cost of the Air Force EA-6B update program?

Admiral MANDEVILLE. Unit cost for the total EA-6B update program—41 aircraft—is $2,980,500 per aircraft.

Senator THURMOND. How much more life may be expected from these aircraft?

Admiral MANDEVILLE. This does not extend their life, per se. It is just updating the capability of the aircraft, primarily.

EF-111 PROGRAM

Senator THURMOND. Now, I have few questions on the EF-111A.

Have the Air Force requirements for the EF-111A jamming system been changed?

General AHERN. No, sir, they are in the process of reassessment. They have not been changed.

Senator THURMOND. If not, why doesn't the Air Force reprogram so as to keep the EF-111 program on schedule?

General AHERN. Sir, we have that under consideration at the present time.

Senator THURMOND. Will 42 EF-111A aircraft be sufficient to meet Air Force operational requirements?

General AHERN. Not totally sufficient, sir, but we believe that it can do an adequate near-term job. For example, in a [deleted] day war, we could cover something on the order of over [deleted] sorties per day with jamming capability, but the total requirement will be something more.

Senator THURMOND. With present F-111A units having only [deleted] percent operational readiness rate, what is the planned rate for the EF-111A?

General AHERN. I would like to supply that for the record, Senator Thurmond.

[The information follows:]

The operational readiness objective rate of the EF-111A is the same as the F-111A, [deleted]. We estimate that failure rates of sub-systems peculiar to the EF-111A configuration will be approximately equal to the combined failure rates of F-111A sub-system to be removed, replaced, or not required for a typical

Digitized by Google

EF–111A mission. For example, the field Mean-Time-Between-Failure (MTBF) of the EF–111A jamming system (10 ALQ–99 transmitters) is estimated to be 10–12 hours. The impact of reliability resulting from adding the ALQ–99 to the F–111A is offset by the removal of the F–111A fire control system and that portion of the bombing navigational system not required for normal EF–111A missions (Low Altitude Radar Altimeter and Terrain Following Radar). These systems have a combined MTBF of 10.9 hours. In a similar manner, the EF–111A ALR–62 terminal threat warning system and the ALQ–137 self-protection systems replace equivalent MTBF systems now in the F–111A.

General GREENLEAF. The objective is [deleted] percent operational readiness.

General AHERN. That is the objective, or the goal.

Senator THURMOND. Is the ALQ–99 jamming system planned for the EF–111A capable of identifying and jamming the Soviet radars which exist today?

General AHERN. Yes, sir, it is.

Senator THURMOND. Does the ALQ–137 meet Tactical Air Force's requirements, considering it was specifically developed for the F–111 and the FB–111's?

General AHERN. Yes, sir, in combination with other EF–111A avionics it does meet tactical requirements. Tactical requirements are living, growing things, changing things, but as of the moment, the ALQ–137 does meet the EF–111A tactical requirements.

Senator THURMOND. What alternatives are being considered to provide the EF–111A adequate self-protection jamming?

General AHERN. At the present time we feel that the systems aboard the EF–111A are adequate, but that will be proven during test and studied continuously throughout the life of the airplane.

Senator THURMOND. I have some more questions. You can answer the rest for the record as you desire to do.

General AHERN. All right, sir.

Mr. CROMWELL. The Navy radar warning receivers.

NAVY RADAR WARNING RECEIVERS

Captain MATHEWS. Good morning, gentlemen. The Navy's tactical electronic countermeasures program objectives are displayed here.

We must require affordable countermeasures suites. We have an objective to obtain a 10-percent increase in survivability. From an effectiveness point of view, we have met that. The cost goal for the equipment suite is generally less than 5 percent. We have maintained that level constantly.

For example, the F–14 is less than that. For our other aircraft, smaller, and cheaper, it might be slightly in excess of 5 percent. Our cost reduction is achieved by engaging in joint programs whenever possible, basically R. & D., and to some limited degree, procurements in the past. We are trying to maintain aircraft commonality both in the Air Force and the Navy, and also within the Navy, by maintaining the same suites in the various tactical aircraft.

Additionally, we achieved cost savings by maintaining industrial competitions as long as possible, and then buying up the hardware in the effective manner.

Digitized by Google

NAVY TACAIR ELECTRONIC COUNTERMEASURES PROGRAM OBJECTIVES

- EFFECTIVE AFFORDABLE COUNTERMEASURES SUITES
- EFFECTIVENESS: 10 TIMES INCREASE IN SURVIVABILITY
- SUITE COST GOAL: LESS THAN 5 PERCENT OF AIRCRAFT
- COST REDUCTION
  - JOINT R&D PROCUREMENT
  - AIRCRAFT COMMONALITY
  - EFFECTIVE ACQUISITION

This Vugraph depicts the fact that there is a phasing down of current aircraft and how the ECM suites are phasing down in [deleted] as our new ECM suites enter in [deleted] and after. Our point here is that we will update existing equipments for the older aircraft we are phasing down, and we will procure new, technically superior equipments for those aircraft which are phasing up in the inventory and have significant levels of inventory in the [deleted] time frame.

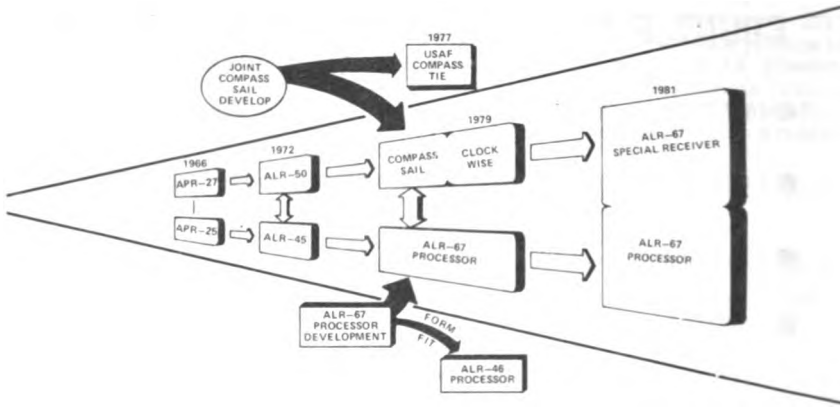
RADAR WARNING RECEIVER PROGRAM

	FY 78	FY 79
PE. 64225 ADVANCED RADAR WARNING	2863	579
• ALR–67 SYSTEM	2863	579
PE. 63206 AIRBRONE EW EQUIPMENT	5437	9175
• COMPASS SAIL CLOCKWISE (CSCW)	650	50
• OTHER MICROWAVE AND INFRARED PROJECTS	4787	9125

Our radar warning programs are containing in several program elements, and they reflect only the cost for the development of the black boxes as opposed to the total group A costs for various aircraft.

Digitized by Google

USN WARNING RECEIVER EVOLUTION



This shows the evolution of the Navy radar warning program. Initially, for Southeast Asia, we developed the APR–25 and APR–27. They were limited in frequency but very adequate for the threat which existed in that time frame.

Subsequently, the increase in threat density and higher frequency demanded that we go to the ALR–45 and ALR–50. These systems are presently installed in fleet aircraft. They are [deleted]. Additionally [deleted]. We need to [deleted].

The ALR–67 system processor being developed will be interchangeable with the ALR–45 analyzer, and in accordance with the memorandum of agreement between the Air Force and the Navy, it will also serve as a potential replacement for the ALR–46 processor.

The ALR–50 [deleted] is being replaced by the Compass Sail, which was a joint Air Force-Navy development. We have had to additionally add to that system a [deleted]. This receiver is form-fit and functionally interchangeable with the existing equipments.

AN/ALR-67 COUNTERMEASURES RECEIVING SET

- REQUIREMENT — IMPROVED TACTICAL THREAT WARNING
- CHARACTERISTICS

DELETED

- CANDIDATE PLATFORMS — EA-6B, AV-8, A-18, F-14, F-18
- STATUS — IN ENGINEERING DEVELOPMENT. INITIAL PROCUREMENT APN-1 IN FY1979, APN-5 IN FY1981
- UNIT COST — S83K

Digitized by Google

Additionally the advanced ALR-67 system is designed to fit in the ALR-45 and 50 space in order to facilitate the installation in our aircraft.

In addition to the capabilities of previous receivers, the ALR-67 has superior capability to detect and discriminate individual threats in a dense environment. The ALR-67 is designed to operate within the severe electromagnetic environment associated with the ALQ-99 support jamming system on the EA-6B.

This chart displays the requirements for all ALR-67's that we project in the future. Requirements for systems to outfit aircraft assigned to active Navy-Marine combat squadrons are [deleted]. The difference is attributed to [deleted]. Aircraft mountings, cablings, antennas, displays, et cetera, are installed in each aircraft. The avionics hardware boxes are procured at a level [deleted] in anticipation of phasedown of candidate aircraft. The current projected requirement for the ALR-67 is [deleted] systems. Most ALR-67's will be purchased as a subsystem of new F-18, A-18, and AV-8B aircraft. Retrofit of F-14 and EA-6B will occur during normal airframe rework.

AN/ALR-67 RETROFIT PROCESSOR

- REQUIREMENT: REPLACE [deleted] ALR-45 ANALYZER
- CHARACTERISTICS:
  - DELETED
- CANDIDATE PLATFORMS: [deleted]
- STATUS: ENGINEERING DEVELOPMENT. START PROCUREMENT FY1979
- UNIT COST: $33K

The ALR-67 processor is form-fit-function interchangeable with the [deleted] ALR-45 analyzer. It has superior capability in handling increased threat density, a much faster processing time, and, it will have interfaces for the [deleted] and the advanced jammer that is under development. The retrofit processors will be capable of returning to inventory as the older aircraft phase out, and will, therefore, offset future procurements of processors for new aircraft.

This Vugraph displays the total requirement for the processors, including the full ALR-67 system. Commencing in fiscal year 1980, we will replace all of the ALR-45 analyzers as rapidly as possible with the ALR-67 processor. The total number will rise until [deleted] procurement will terminate with [deleted] processors.

The Compass Sail Clockwise system is to form fit and functionally interchangeable with the existing ALR-50 and performs all of the ALR-50 [deleted] functions as well as [deleted]. Only the ALR-50 antenna and cabling replacement is required.

88-370 O - 77 - 15

Digitized by Google

COMPASS SAIL CLOCKWISE

REQUIREMENT:

CHARACTERISTICS:

- DELETED
- **FORM-FIT SIZE OF ALR-50**

CANDIDATE PLATFORMS:

DELETED

STATUS: **ENGINEERING DEVELOPMENT, INTRODUCTION 1980**

The system will only be installed on those aircraft which are phasing down in the 1980 timeframe. We plan to have a total of [deleted] systems procured with introduction into the fleet in [deleted]. It will replace all ALR-50's in the active combat aircraft. We will have everything outfitted by [deleted]. However, this system will remain in inventory primarily in the Reserves out to [deleted].

Sir, that concludes my formal presentation. I will be glad to respond to any questions.

Senator THURMOND. Counsel has some questions.

STATUS OF NAVY RWR'S

Mr. CROMWELL. It appears from your presentation, Captain, that the Navy is going to be in real trouble in the area of radar warning receivers until about the mid-1980's.

Is that a valid conclusion to draw from the data that has been shown here?

Captain MATHEWS. The existing systems are [deleted] and you are quite right, we do not have a [deleted].

Mr. CROMWELL. I have got some questions which I believe will be joint to the Air Force and the Navy, and maybe Colonel Gilroy wants to come up.

AIR FORCE-NAVY MOU

Would you explain the background of the Air Force and the Navy MOU on radar warning receivers?

Anybody can field that.

Captain MATHEWS. Yes, sir.

Digitized by Google

There was a consideration for the Navy to utilize the ALR–46 system. However, the ALR–46 system, as it is presently being produced by the Air Force, will not physically fit into our existing aircraft. However, it was desired that the ALR–67 processor be retrofittable in the ALR–46. Because the ALR–67 system was being designed primarily for the EA–6B, it had to have different capabilities than the existing ALR–46. From those requirements, plus the desire for better cooperation between the Air Force and the Navy in the development of subsequent systems, the MOU was generated.

Mr. CROMWELL. Was it Navy initiative, Air Force initiative? Who was it that generated it?

Captain MATHEWS. If I remember correctly, it was D.D.R. & E. It was to both of our benefits, however.

Mr. CROMWELL. Is the threat to the Air Force different from the threat to the Navy, in the sense that there are different requirements? Does that generate different requirements in the area of radar warning receivers?

Colonel GILROY. We came to the agreement that the threat is the same. Part of the memorandum of agreement is to, within 1 year of initiation of the memorandum of agreement, which I guess will be this summer, at that time come up with a joint statement of requirements for future radar warning receivers. This is based upon the fact that we do agree the threat is the same.

At the present time I think we would say that the density which the Air Force faces in the central European environment is probably a little more severe than what the Navy faces.

Mr. CROMWELL. Is the ALR–67 processor going to be retrofitted into Air Force airplanes?

Colonel GILROY. We haven't made that decision yet, sir, but if we come to the conclusion that we need a faster processor or a better processor, then the ALR–67 processor was designed to fit right in.

Mr. CROMWELL. All right.

F–15 RWR

Now, if the threat is common, how did it happen that a unique radar warning receiver was developed for the F–15?

Colonel GILROY. I will have to refer to my notes on that.

The F–15 radar warning receiver was designed, as I mentioned before, to provide power management capability for the F–15, power managing the ALQ–135, the internal countermeasures. That was our first effort at power management. We had pods that, you know, you either turned on or turned off. You had nothing in between the two. This was the first attempt to gain better use of the available jamming power, and was also part of the total weapons procurement package, where the director had complete authority to put what he wanted, the best available technology, in the airplane, which at the time was the ALR–56 and the ALQ–135, internal countermeasures system.

Mr. CROMWELL. Well, that is past history. Now as we go downstream from here, do you see developing unique equipments in the radar warning area that would be applicable only to one airplane in the future?

General AHERN. No, sir. All our efforts are exactly in the opposite direction. We try to go toward commonality, where we have vehicles

Digitized by Google

such as the F–16, F–18, and there are opportunities there for commonality. There are certain problems that make it a little bit more difficult than it would appear to be on the face of it, but our efforts are to try to go toward common equipment, if at all possible.

FUTURE JOINT REQUIREMENTS

Mr. CROMWELL. Is there any long-range plan to achieve commonality between the services in this?

General AHERN. Yes, sir, there is; very definitely, and it will start with the joint service operational requirement, and I think that will take us a long way down the road.

Admiral MANDEVILLE. Yes, sir, I agree with that. This is where we are headed with each of the requirements, I would say, in the future would be joint. I can't imagine why—right now I can't imagine a situation where we would try to go separate on a particular system.

Mr. CROMWELL. At what point in time—what would be the earliest point in time at which you would see the common system in this area?

Colonel GILROY. That is a little difficult to tell right now, sir. The ALR–46 Compass Tie we see fulfilling all of the requirements as far as we see the threat developing today.

It would require a big change, I think, in the type of threats before we start development on a new system using completely common hardware.

General BOND. Let me try to answer that, sir. As a result of the existing inventory, the ALR–56 going into the F–15 that exists today, the next near-term opportunity to have a common system with the Navy, and we have a joint program going on now, is to develop an internal system for the F–16 and the F–18. In the Air Force, it is a joint program, we are studying it together. The Air Force has somewhat of a problem in that we have a space problem in the F–16. We have a very stringent design-to-cost goal to total weapon system cost, and we have not made the decision yet on installing that internal system in the F–16, but it is a joint program. It is desirable from an aircraft performance standpoint to install an internal system, if we can accommodate it, both from a hardware standpoint internal to the airplane, and financially.

Again, that decision has not been made, but as far as common system, I think that is the next year term opportunity to be absolutely common with the Navy.

Mr. CROMWELL. Are you speaking of radar jammers or radar warning receivers?

General BOND. I am speaking of jammers, sir.

Mr. CROMWELL. Well, at present I was limiting the question to the radar warning receiver area, but it would appear that since the Navy isn't even going to get its ALR–67 in its inventory, until the mid-1980's, that it would beyond 1985 that any new but common—the opportunity for a new but common system would be there.

Admiral MANDEVILLE. I would think that is probably correct, Mr. Cromwell. Of course, we have got the sunk cost problem. If we want to go just for something common and get rid of any equipment we have that we have expended money for, you know, it would have to be a

Digitized by Google

requirement in the growth arena, and you are probably correct in your assessment.

Mr. CROMWELL. We are talking about commonality for radar warning receivers.

Do these next generation receivers that were presented today have a requirement to cue the jammers, power manage the jammers or cue the jammers?

Captain MATHEWS. That is correct.

Mr. CROMWELL. Bob has a question.

CHART COMPARING RWR'S

Mr. OLD. Is there some way for the layman that the two services could put together a chart and show what threat it is you are trying to counter and what system the Air Force uses and what system the Navy uses, and just kind of take that down some sort of a parallel column, with maybe some explanation at the bottom of how it is you might eventually try to get together?

General AHERN. Yes, sir, we can provide that for the record.

Mr. OLD. I think I am reasonably familiar with this, but I do get confused with all the numbers and what system is trying to do what.

General AHERN. Yes, sir, we will provide that for the record. That is an extremely complex area, extremely complex.

Mr. OLD. I think that would be helpful.

Thank you very much.

[The information follows:]

The three services, Army, Navy, and Air Force have developed charts which describe the various radar warning receivers and electronic countermeasures jammers, applicable aircraft, threat handling capabilities, and status of systems. Additional data on joint USAF/USN electronic warfare efforts is also provided.

[Charts deleted.]

RADAR WARNING RECEIVERS (RWR)

1. The Air Force and Navy have signed a Memorandum of Agreement (MOA) on Radar Warning Receivers (RWR) for USN/USAF Tactical Aircraft.

(*a*) This MOA establishes a collaborative effort between the two services for the purpose of achieving technological advances in RWR capability, while maintaining efforts which are in concert with common requirements.

(*b*) The MOA recognizes that there are differences in RWR technical requirements due to differences in weapons systems integration factors and sunk costs.

2. The MOA outlines specific areas of receiver/processor technology to be pursued jointly by the two services.

3. The two services will formulate a joint statement of requirements to insure that any new receivers or any subsequent updates will have maximum commonality.

JAMMING SYSTEMS

The Air Force and Navy have entered into a Memorandum of Agreement in which the two services agree jointly to pursue the definition of a common internal self-protection jamming set for the F-16, F-18, and other aircraft.

Although no decision has been made to install an internal jammer in the F-16 and recognizing the differences in technical requirements due to aircraft installation, benefits would still occur to both services from the current definition effort, as well as any future development.

General CANEDY. Mr. Old, are you excluding the green suiters?

Mr. OLD. No, sir, I am not.

Well, I apologize for overlooking the green suiters. You probably have a greater requirement than any of the other services.

Digitized by Google

General CANEDY. Less demanding.

General GREENLEAF. Mr. Old, General Smith would like to join.

Mr. OLD. Be my guest, and if the Coast Guard has a requirement, they can join in.

Mr. CROMWELL. OK, now, the jammer programs.

AIR FORCE ELECTRONIC COUNTERMEASURES PROGRAMS

Colonel GILROY. Sir, the second section of the briefing is the electronic countermeasures.

In the Air Force portion of the briefing I will cover both the external ECM pods and the internal ECM systems.

ELECTRONIC COUNTERMEASURES (ECM)

PURPOSE

TO EFFECTIVELY COUNTER SOVIET RADAR SYSTEMS ASSOCIATED WITH:

- SURFACE-AIR-MISSILES
- AAA
- AIRBORNE INTERCEPTORS

OBJECTIVES

- TO ENHANCE AIRCRAFT SURVIVABILITY AND PENETRATION CAPABILITY
- TO MAXIMIZE USE OF CURRENT ECM SYSTEMS
- TO MINIMIZE THE IMPACT OF THE ENEMY'S ELECTRONIC COUNTER-COUNTERMEASURES

The active ECM systems in conjunction with radar warning receivers are essential for self-protection of our tactical aircraft in the environments which we face today and can expect to face in the future. Our active ECM system development, like our radar warning receivers development, is driven by the fact that the Soviets are developing sophisticated defensive systems of increased quantities and types.

In attaining this capability, we must constantly evaluate whether it is more cost effective to update existing systems or to replace them with newer systems, having greater growth potential.

ELECTRONIC COUNTERMEASURES (ECM) SCOPE

EXTERNAL (ECM PODS)

- ALQ-119
- ALQ-131

TAC FTRS

INTERNAL

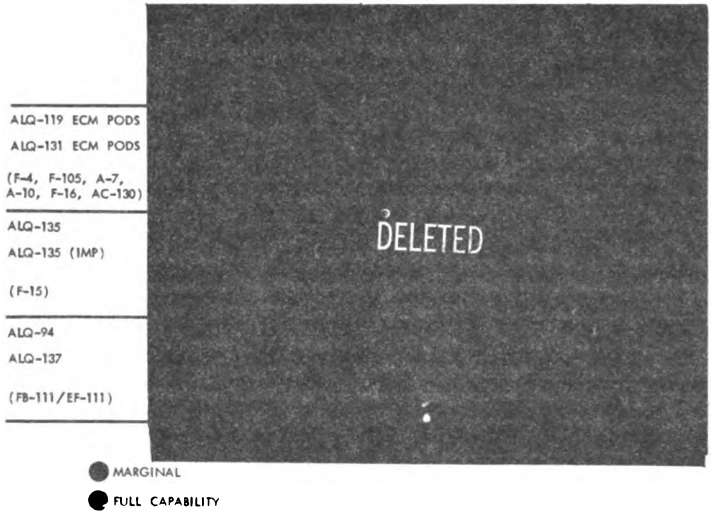
- ALQ-94 (F/FB-111)
- ALQ-135 (F-15)
- ADVANCED SELF-PROTECTION JAMMER

Digitized by Google

My briefing will cover the external ECM systems, the ALQ–119 and ALQ–131 ECM pods, as well as the internal systems, the ALQ–94 on the F/FB–111 and the ALQ–135 in the F–15. Consideration is being given to developing an internal ECM system for possible use on the F–16, although no decision has been made at this time. If we proceed with the development of a new internal ECM system, it would be a joint effort with the Navy. It will be addressed in more detail later in this briefing and in the followon briefing by the Navy.

PRESENT

AIRCRAFT JAMMING SYSTEMS VS THREAT



This rather busy chart shows the operational capabilities of our existing ECM systems against terminal threat radars, as well as the equipment updates to correct some of these deficiencies. The red dots indicate the lack of frequency or antenna coverage to counter the specific threats shown. [Deleted.] A marginal capability, depicted in yellow, is shown if we do not possess adequate intelligence data on a radar or have not demonstrated an effective ECM technique. As I mentioned earlier, we are updating our ECM systems to provide [deleted] frequency coverage as well as to implement new jamming techniques to counter some of the latest and more sophisticated Soviet radars.

You can see in some of our new equipment which we are presently procuring, that all of the threats are not covered. [Deleted.]

We included also in this chart some of the [deleted] but we do have some laboratory programs going on to develop countermeasures.

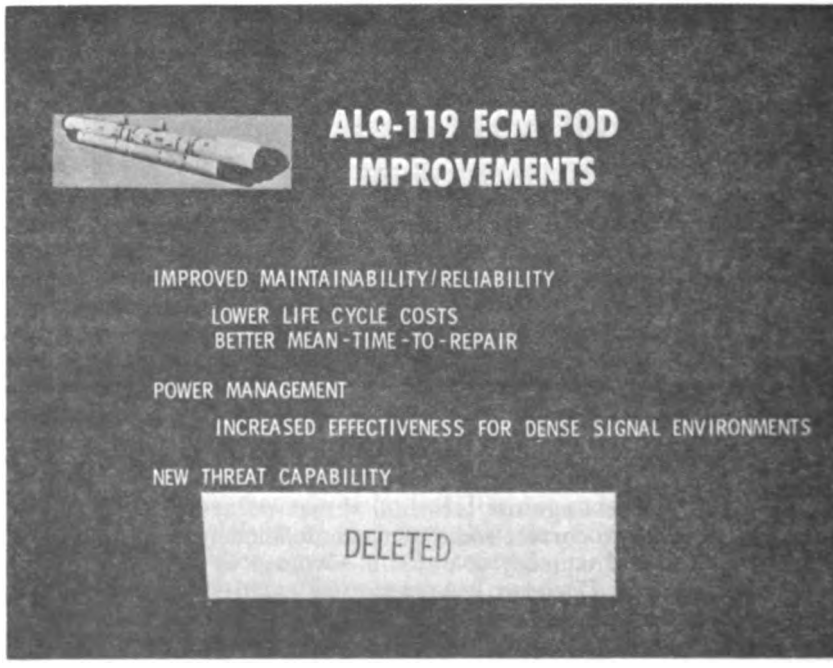
The ECM pod program has two specific objectives. The first is to provide the maximum degree of capability to our existing ALQ–119 ECM pod. To accomplish this task, we have underway a series of update efforts that are intended to substantially improve the ALQ–119s performance. Our second objective is to develop an advanced ECM pod for the longer term. This new pod, designated the ALQ–131, will

Digitized by Google

ECM POD PROGRAM OBJECTIVES

- MAXIMIZE CAPABILITY OF EXISTING ALQ-119 PODS
- DEVELOP NEW, INCREASED CAPABILITY FOR ALQ-131 PODS

not only include the required threat jamming capability, but will also incorporate improved operational flexibility, maintainability, and reliability features.



In order to improve the overall capability of our current firstline have initiated the series of update modification efforts shown here. ECM pod, the ALQ-119 now numbering approximately [deleted] we

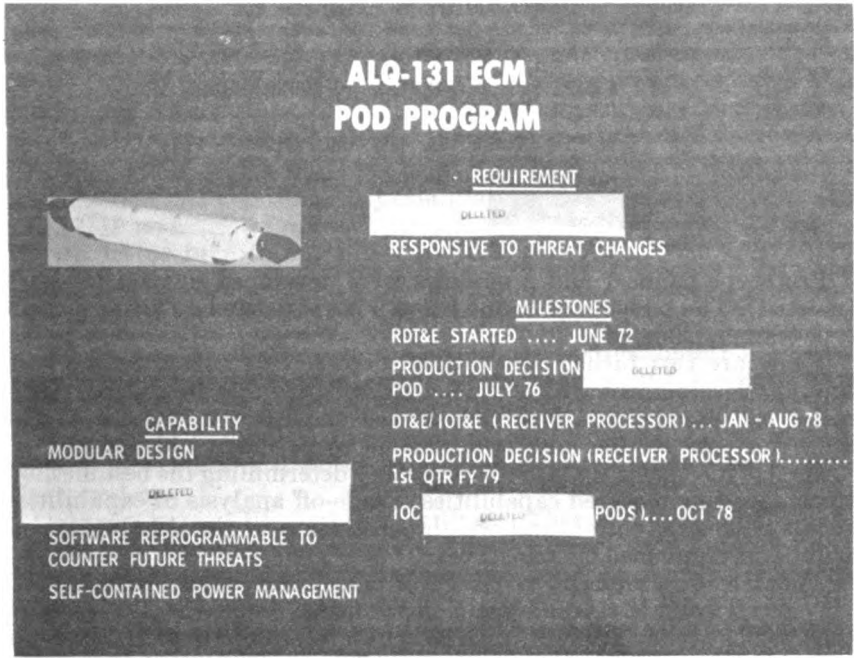
The first task is to increase the pod's maintainability and reliability by incorporating modest design changes. These changes will result not only in lower overall life cycle costs, but will decrease the mean time to repair. These improvements include better flight line maintenance accessibility, improved ground handling equipment, and more reliable ground support equipment.

Our second task is to incorporate a power management capability which will permit increased jamming effectiveness. This is achieved

Digitized by Google

by automatic assignment of concentrated available jammer power on priority threats. The power management concept is accomplished by integration of the pod and the radar warning receiver to automatically counter threat radars thereby significantly reducing the aircrew workload. This improvement will also incorporate software provisions to permit more rapid response to changes in the threat environment.

The third task will incorporate additional frequency capability and the ability to generate new ECM techniques. These improvements are necessary to [deleted].



For the long term, we require an ECM pod for our tactical aircraft, which not only provides [deleted] but also allows rapid response to enemy threat parameter changes and is more easily maintainable. The ALQ–131 ECM pod was designed to satisfy these requirements.

The ALQ–131 pod is modular in design which means that different pod modules may be added or deleted to yield missionized pod configurations. The pod will be available in two major production configurations. The first is a [deleted] version designed to jam radars [deleted]. The second configuration being considered [deleted]. With this modularity, a tactical commander will be able to tailor his pod equipment for the mission requirement.

Another important feature of the ALQ–131 pod is its ability to be quickly reprogramed in response to threat changes by making changes to software in the pods digital computer. This feature will minimize the need for costly future hardware modifications, taking long periods of time to accomplish when changes in threat techniques or parameters occur.

Digitized by Google

The final capability of this pod is the self-contained power management feature. This capability is included in a single receiver-processor module which not only detects radar threats but also directs the optimum jamming program.

ALQ-131 ECM PODS

BANDS 1 & 2

ADD [DELETED] CAPABILITY TO ALQ-131 ECM POD

CURRENT STATUS AND SCHEDULE

ASSESS SYSTEM CAPABILITY TO COUNTER SOVIET DEFENSE - FY 77

DEVELOP BREADBOARD, TEST AND EVALUATE - FY 78

FABRICATE PREPRODUCTION SYSTEM - FY 79

[redacted]

Prototype bands 1 and 2 modules were developed in parallel with [deleted]. The purpose of bands 1 and 2 is to [deleted]. During prototype testing, [deleted].

There are two furher issues which need to be resolved before continuing development of the [deleted] modules: 1, production estimates for bands 1 and 2 are considered excessive; 2, current threat scenarios may require additional frequency coverage [deleted].

The USAF currently is in the process of determining the best method to achieve this required capabilities. Trade-off analysis of capabilities versus cost, size, power, and weigh constraints of the ALQ-131 pod will be accomplished this fiscal year.

Turning for a moment to our ECM pod procurement program, you may recall from last year's testimony that our requirement is to equip each combat coded aircraft, with either an internally installed jammer or an ECM pod. The top curve of this chart illustrates our current projection for tactical aircraft which will require ECM pods.

The bottom curve shows the total number of ECM pods projected to be in the inventory by fiscal year [deleted]. This projection is based upon ALQ-101-10, ALQ-119 and ALQ-131 ECM pods since they are the only pods which can provide the required capability.

This chart shows both the R. & D. and procurement funding requirements for our ECM pod program. The fiscal year 1977 R.D.T. & E. funding shown for the ALQ-131 will be used to continue the development of the receiver-processor, and bands 1 and 2, and to initiate development of improved power tubes. Fiscal year 1978 funds will be used to continue the last two efforts. The fiscal year 1977 R.D.T. & E. funding for the ALQ-119 will be used to continue this effort as well as to initiate an effort to improve the reliability of the ALQ-119 tubes.

The procurement funding in fiscal year 1978 reflects the procurement of 50 ALQ-131 [deleted] pods as well as ALQ-131 receiver-

Digitized by Google

ECM POD PROGRAM FUNDING

($ IN MILLIONS)

RDT&E	FY TQ & PRIOR	FY 77	FY 78	FY 79	TO COMP
PE 64739F					
ALQ-131	26.9	2.5	1.9	1.6	.5
ALQ-119 THREAT UPDATE	0	2.0	3.2	.9	
PROCUREMENT					
P-1900					
ALQ-131 PROCUREMENT	51.3	50.0	50.0	65.0	210.0
POD UPDATES		19.6	30.0	19.5	183.4

processor modules. We also plan to start procuring power management modification kits and reliability/maintainability improvements for the ALQ–119 pod.

Now let us turn to our internal ECM program.

FUNDING FOR NEW AND OLD PODS

Mr. CROMWELL. Before you go on, let me ask one question on that procurement chart. You show $210 million being spent beyonnd 1979 to buy ALQ–131's, and $183 million is to update the old pods.

Will you be looking at the cost trade-offs involved there, because the old pod, being hard wired, is going to require update after update after update.

Colonel GILROY. We certainly will, sir. That is a very good point.

This line here includes more than updates for the ALQ–119 pods. This is also where the procurement money for the receiver processors, bands 1 and 2 and updates not only for the ALQ–119, but also updates which we will require in the outyears for the ALQ–131, which new equipment maintains its capability as threat changes.

Mr. CROMWELL. Is that more generality or a hard figure planning program?

Colonel GILROY. Yes, sir.

Mr. CROMWELL. All right, thanks.

INTERNAL ECM PROGRAM OBJECTIVES

UPDATE EXISTING SYSTEMS TO COUNTER LATEST THREATS

PROCURE ONE SYSTEM PER EACH COMBAT CODED AIRCRAFT

Digitized by Google

Colonel GILROY. Our objective in the internal is the same as the external, that is, to update the existing systems wherever possible, and to fill our systems with one system for each aircraft that doesn't have it.

RDT&E PROGRAM

($ IN MILLIONS)

		FY TO & PRIOR	FY 77	FY 78	FY 79	TO COMP
PE 64738F	ALQ-94 CONVERSION TO ALQ-137	21.5	1.6	1.9	6.0	15.5
PE 64739F*	ALQ-135 IMPROVEMENTS		5.8	8.0	4.8	CONT
PE 64739F	ADVANCED SELF-PROTECTION JAMMER			6.9	9.5	8.0

* FUNDED AS PE 64748F IN FY 77 AND PRIOR

Our R.D.T. & E. program is directed toward updating the ALQ-94 and ALQ-135 while participating in the joint service definition of a new internal system. The primary emphasis in our update program is to provide frequency coverage [deleted], and to develop new techniques to counter threats [deleted]. We have taken a close look at existing internal systems [deleted]. We feel strongly that the development of a new internal system is required in order to have it ready for present and next generation aircraft. Doing this in concert with the Navy for their F-18 should prove to be a very cost effective program.

The details of this program will be covered by Captain Mathews.

That concludes the Air Force portion of the ECM briefing.

Mr. CROMWELL. All right, I will hold the questions and have joint questions.

NAVY ELECTRONIC COUNTERMEASURES

Captain MATHEWS. We have the same program objectives for the jammers as our radar warning receivers. We have engaged in joint programs in R. & D. We believe this will be a tremendously effective way to reduce costs both in long term R. & D. programs and in procurements.

This shows the configuration we propose for tactical aircraft. The newer aircraft, those which have significant quantities in inventory in the 1990 timeframe, we plan to provide the airborne self-protection jammer, which I will be discussing in detail. This system has [deleted]. This is the best combination that can be obtained for self-protection of aircraft. The AV-8, we are required to develop a new pod specifically for that aircraft because of the lack of internal space, and also the severe physical size constraints of the aircraft.

The older aircraft, those I indicated earlier that we are phasing down in the inventories, we intend to update the ALQ-126, which was

Digitized by Google

initially introduced in 1972. We are developing also a relatively inexpensive jammer to address specifically the CW threats. We do not have any capability of high powered noise.

JAMMER R&D PROGRAM

	FY 78	FY 79
PE. 64226 AIRBORNE SELF–PROTECTION SYSTEM	5175	14916
• AIRBORNE SELF–PROTECTION JAMMER (ASPJ)	5175	14916
PE. 64224 TACTICAL AIRBORNE ADAPTIVE ECM SYSTEM	2524	5894
• ADAPTIVE ECM POD	2124	4994
• CLOCKWISE JAMMER	400	900

Development funds for the Airborne self-protection jammer, ECM pod and the Clockwise jammer, are contained in separate program elements.

AN/ALQ-126 UPDATE

- REQUIREMENT: IMPROVE ALQ–126 PERFORMANCE
- CHARACTERISTICS:

DELETED

- CANDIDATE AIRFRAMES: DELETED RA–5, A–6, EA–6, A–7, F–4, RF–4, F–14
- STATUS: NON–RECURRING ENGINEERING FY1979, UPDATE FY1980–1983
- UNIT COST: $40K

The ALQ–126 update program is a hardware modification to the existing equipment. It will be fundamentally a product improvement. Further, the update costs of this system will be minimized by requiring no additional changes to the present aircraft installation. The primary improvements planned are a firmware reprogramable capability and updated threat logic.

Mr. CROMWELL. What is the definition of firmware?

Captain MATHEWS. As opposed to being able to program a system with a tape, these are burned logic chips. They generally have additional unused portions of the chip which can be changed by crossing out the old and burning in new logic. So it is changeable in an I level maintenance facility.

Mr. CROMWELL. The same system is used by the Air Force, isn't it, in the ALR–46 Compass Tie?

Colonel GILROY. Yes, sir.

Digitized by Google

Captain MATHEWS. These changes would obviate time consuming and costly modifications to the present hard wired system and would stabilize the system to minimize lifecycle costs during the remainder of the service life of the older aircraft. This indicates the update requirement of ALQ-126 black boxes. Again, installation is in the aircraft which are phasing down in inventory from 1980.

You will notice that this box, originally procured in 1972, will exist in significant quantities in the [deleted] time frame.

The Clockwise jammer is in the advanced development phase, and is required as the [deleted].

The Clockwise jammer will be installed primarily in the older aircraft which are phasing down in inventory. A total procurement of [deleted] systems is planned and will be sufficient for meeting the deployment and training requirements through the 1990 time frame.

CLOCKWISE JAMMER

- REQUIREMENT: DELETED
- CHARACTERISTICS: DELETED
- CANDIDATE PLATFORMS:
- UNIT COST: S10K

The adaptable ECM pod now under development will provide a capability to counter the threat systems associated with close air support mission. It is specifically designed for the AV-8 Harrier [deleted].

ADAPTABLE ECM POD

- REQUIREMENT:
- CHARACTERISTICS: DELETED
- CANDIDATE PLATFORMS: AV-8A/B/C
- STATUS: ENGINEERING DEVELOPMENT. FY 1981 PRODUCTION
- UNIT COST: S250K

One hundred ECM pods are initially planned for the Harri- quantity is sufficient to meet deployment, training, and sp- ments as well as a small number to support the AV- and initial procurement.

Digitized by Google

AIRBORNE SELF-PROTECTION JAMMER

- REQUIREMENT: IMPROVED COUNTERMEASURES FOR NEWER AIRCRAFT
- CHARACTERISTICS:

DELETED

- CANDIDATE PLATFORMS: NAVY-EA–6B, A-18, F-14, F18: AIR FORCE-F-16
- STATUS: IN ADVANCED DEVELOPMENT, ENGINEERING DEVELOPMENT IN FY1977, PROCUREMENT IN FY1982
- UNIT COST: $250K

The Airborne Self Protection jammer is now in advanced development for Navy aircraft. As part of our current efforts, we are engaged in a joint program with the Air Force to define a common system for full scale development. The jammer must be integrated with the onboard radar warning system for power management. Additionally, the jammer must operate harmoniously with other aircraft weapons systems. Hence, the trend in tactical countermeasures equipment development is toward a fully integrated system. At this time, only the R. &. D. profile is included in the fiscal 1978 budget. Production funds are not estimated to start until fiscal year 1982, and will be included in a subsequent budget.

Most ASPJ's will be purchased as a subsystem of new production aircraft. Only the F–14 and EA–6B will have significant retrofit quantities. Current projections indicate that a quantity of [deleted] systems is sufficient to meet EA–6B, F–14, F–18, and A–18 requirements for combat aircraft throughout the life of the ASPJ program.

COUNTERMEASURE SYSTEMS DEVELOPMENT GOALS

- RESPONSIVE TO THREAT
- CAPABLE AND ADAPTABLE
  - DUAL MODE – PULSE, CW AND NOISE
  - SOFTWARE PROGRAMMABLE
- COMMONALITY
- IMPROVED TECHNOLOGY

In summary, I would like to say that we are attempting to the best of our ability to maintain systems which are responsive to the threat. They must be capable of various modulation techniques, they must be

Digitized by Google

adaptable, and we are going to the systems which contain both pulse, CW, and high-powered noise. All systems under development, including all radar warning systems, are software programable. We are stressing commonality both between our own aircraft and the Air Force in our joint programs. However, this in fact places severe constraints because of physical form-fit interchangeability requirements, and these constraints have forced designs into greater integration and miniaturization which demand improved technology.

Sir, that concludes my presentation.

COMMONALITY IN INTERNAL JAMMERS

Mr. CROMWELL. Is it technically more difficult to develop an internal jammer which would be common across different aircraft, as opposed to the problem of developing a common radar warning receiver?

Captain MATHEWS. We have always built, with one exception, internal systems. There are different problems associated with it. The environment in the aircraft is frequently less severe than external. We also generally have provided to us those environmental things that have to be placed in the pod.

I think the constraints are different, but I don't necessarily agree they are difficult.

Mr. CROMWELL. You don't agree that it is more difficult?

Captain MATHEWS. Not if one can find adequate space and cooling power and that sort of thing. We are constrained by that aspect. If one puts that constraint on us, yes. I will go along with that.

Mr. CROMWELL. That makes it, from a practical standpoint, a much more difficult problem, doesn't it, because of those practical constraints?

Captain MATHEWS. Yes, sir. It is my judgment it is.

Mr. CROMWELL. Is the ASPJ being equally funded by the Air Force and the Navy?

Captain MATHEWS. At the present time, it is our advanced development program, but we have shared certain costs in the definition of the future system.

Mr. CROMWELL. Is the Navy requesting any fiscal 1978 funding for ECM jammer procurement?

Captain MATHEWS. No, sir.

Mr. CROMWELL. Is it just modification funding?

Captain MATHEWS. And installation. There is no new black box procurement.

JAMMING PODS FOR HARRIER

Mr. CROMWELL. Why is a separate jammer pod being developed for the AV-8 when there are so many pods currently available?

Captain MATHEWS. There are no ECM pods currently available that will fit on the AV-8. They all require a repackage effort.

Mr. CROMWELL. I notice here funding, what is the funding and the status of the AV-8 pod?

Captain MATHEWS. We have funding in the budget for the AV-8 pod.

Mr. CROMWELL. Did you say the fiscal 1978 request?

Digitized by Google

Captain MATHEWS. For the development; yes, sir.

Not into production.

Mr. CROMWELL. I missed it. How much was in the fiscal 1978 budget for the AV–8 pod?

Captain MATHEWS. I can give you the precise number although I don't have it at the moment.

Mr. CROMWELL. Was it in your presentation?

Captain MATHEWS. Yes, sir.

Mr. CROMWELL. When was that pod program started?

Captain MATHEWS. It initially started with the development of the Navy development coordination paper in June of last year.

Mr. CROMWELL. So that is a new start from a funding standpoint.

Captain MATHEWS. Yes, sir.

ALQ–137 JAMMER

Mr. CROMWELL. On the ALQ–137, SAC apparently has a hard wired version of the 137, is that right?

Colonel GILROY. Yes, sir.

Mr. CROMWELL. Is that usable by TAC?

Colonel GILROY. Just to give you a little background, we plan to commence the class V modification program this fall to install this hard-wired version of the 137 in the FB–111. When the requirement came into the Air Force several years ago, SAC initiated a requirement to update the ALQ–94 to give us the [deleted]. We queried Tactical Air Command as to whether they were interested in using the same system, seeing as they had that same type system in their 111s. At that time the Tactical Air Command came back and said no, they were not interested in this because it didn't give them a sufficient increase in capability above what they had with the ECM pods, because they could carry the old internal system plus an ECM pod near the speed brake on the 111.

Since that time, TAC has come back in with a requirement, which has not been approved by the Air Staff yet, which is scheduled, I believe, next month or the month after, to go before the Requirements Review Group to ask for an [deleted].

The Air Staff has not come to a decision yet as to whether they will approve this update for the tactical fleet.

Mr. CROMWELL. OK.

ALQ–126 MODIFICATIONS

I understand that the ALQ–126 is reported to be underpowered and have a very poor tail radiation pattern through the rear.

Is that correct, and then does the update improve that capability?

Captain MATHEWS. The update program does not at the present time. We have got to change the antenna configuration. The principal problem in developing coverage is the power one can get out of the system in the space. Since the radar cross-section is highest on the wing, we essentially do not cover that beam aspect. We, however, are looking at ways of improving the existing antenna pattern on all aircraft at our Johnsville facility.

At the present time, our program does not include specific actions to improve that.

Digitized by Google

NAVY LAGGING BEHIND AIR FORCE

Mr. CROMWELL. As an overall impression from the briefing that has been given, the Navy appears to be behind in power contrasted with the Air Force, in the area of ECM jamming protection.

Would you disagree with that, Admiral Mandeville?

Admiral MANDEVILLE. No, sir; I wouldn't agree. I think our update on the ALQ–126 is from the pure technical point of view, the best we can do just from a technical sense. We may hurry it up a month or two, but we are just trying to balance it and make do with what we have, and we are also trying to go for the follow-on state-of-the-art jammer, which I think the ASPJ will give us.

Mr. CROMWELL. All right, fine. Thank you.

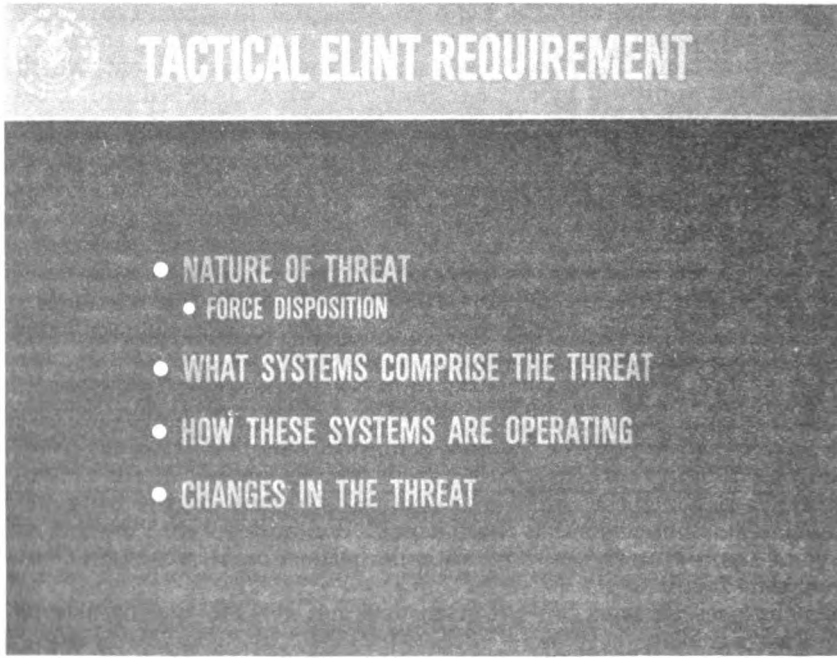
General AHERN. If it is agreeable, then, sir, we will move on to the Elint concept of operations.

The first briefer is Lt. Col. Larry Williamson, Chief of Elint Requirements and Program Section in the Directorate of Resource Management for the Assistant Chief of Staff, Intelligence.

USAF TACTICAL ELINT

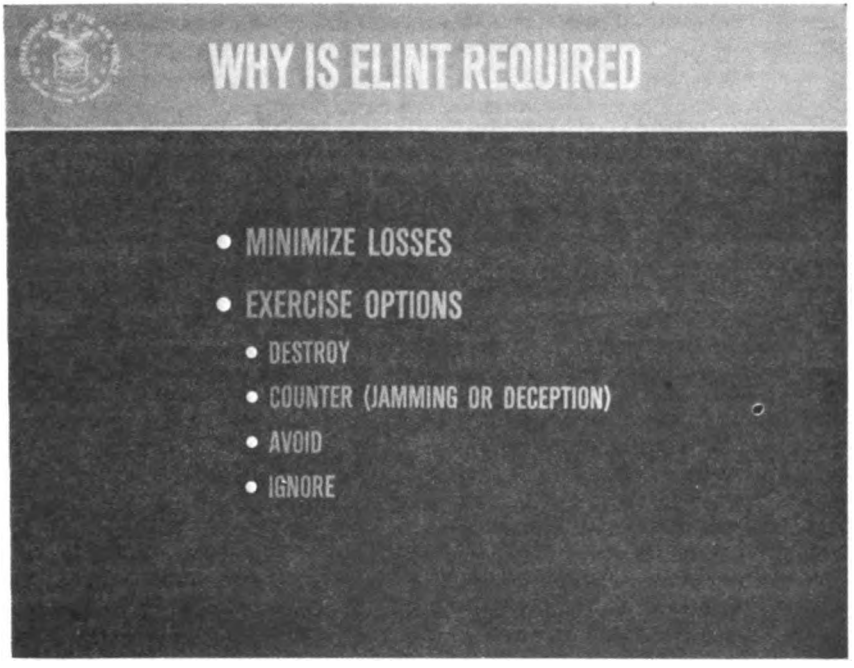
Colonel WILLIAMSON. Last week you were provided a joint scenario covering application of reconnaissance, tactical intelligence, close air support, and defense suppression.

I will address within that scenario what the combatant commander needs in terms of Elint support, why he needs it, and then we will discuss the Air Force and Navy programs designed to satisfy these requirements.


TACTICAL ELINT REQUIREMENT
• NATURE OF THREAT
• FORCE DISPOSITION
• WHAT SYSTEMS COMPRISE THE THREAT
• HOW THESE SYSTEMS ARE OPERATING
• CHANGES IN THE THREAT

Digitized by Google

The combatant commander must know what the nature of the threat is, that is, force disposition, what it is, how it is operating, for example, is there anything unusual about it, and when it changes, either in location or mode of operation. Those weapons systems which pose the most immediate threat to combat operations comprise the greatest and highest priority threat. These are normally the surface-to-air missiles, antiaircraft artillery, and ground control radars which direct airborne intercepts.

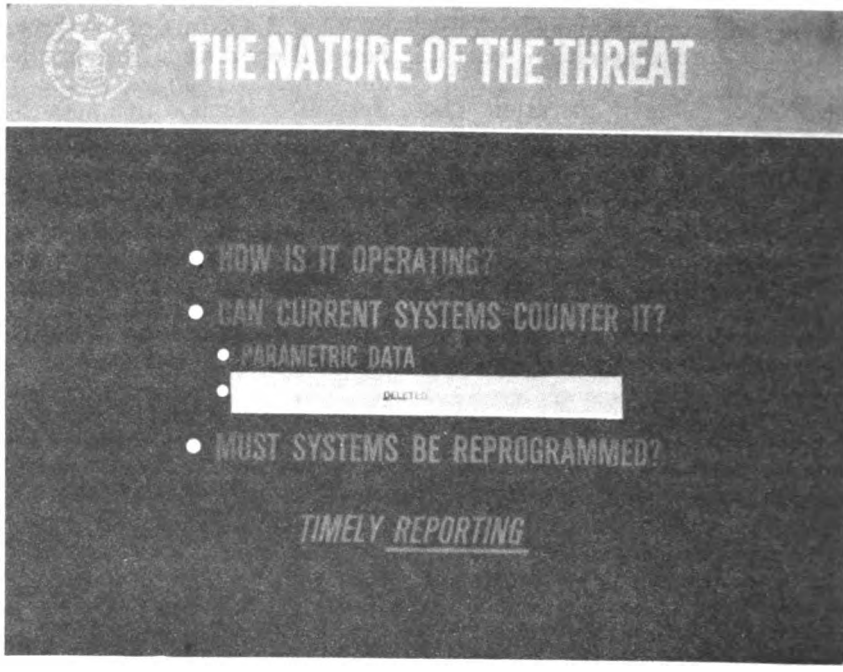


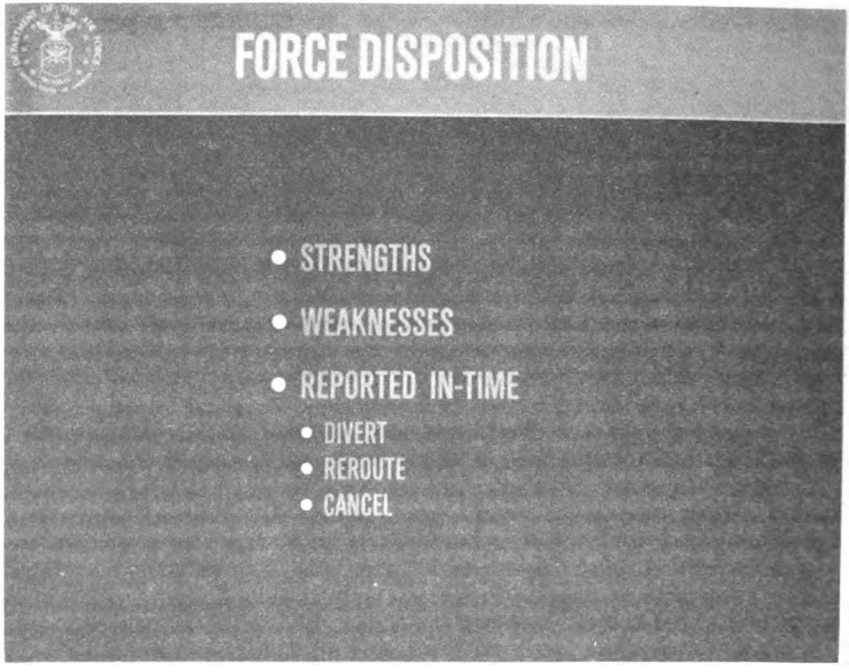
The combatant commander is concerned with getting weapons on target with minimum losses. Timely Elint data are used to minimize those losses. It can tell him the type of threat he faces and its location, enabling him to select an appropriate weapons system option. He can destroy the system; he can counter it by jamming or deception; he can elect to avoid it by flying under the radar coverage; or he may, in some instances, simply ignore the threat and accept the risk if the target the system is protecting is sufficiently important.

To select the correct option, the combat forces need to be kept informed on the nature of the changing threat, for example, how it is operating. This includes the parametric data such as pulse width, frequency, and antenna scan, associated with known threat systems as well as detection and identification of signals associated with new systems which could pose a threat.

Several years ago, fiscal constraints and the need to be able to respond more rapidly to a changing threat, dictated that we more prudently employ our electronic warfare assets. We are automating our EW systems so that the system will recognize the threat type and

Digitized by Google


THE NATURE OF THE THREAT
• HOW IS IT OPERATING?
• CAN CURRENT SYSTEMS COUNTER IT?
• PARAMETRIC DATA
• [redacted]
• MUST SYSTEMS BE REPROGRAMMED?
TIMELY REPORTING



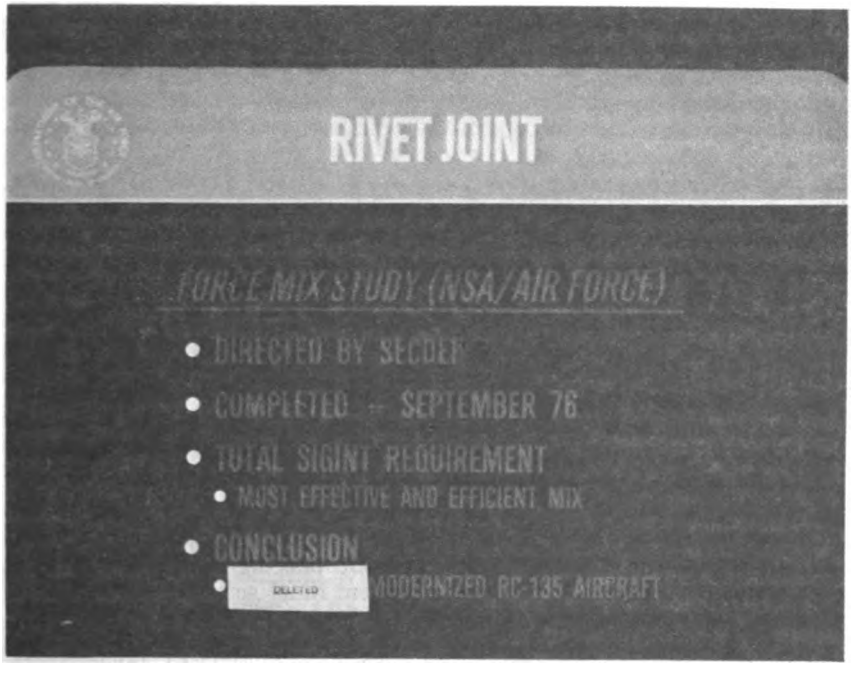
Digitized by Google

apply, in real time, the correct jamming or deception technique. The recognition circuits are established using known parameters of the threats. This software must be reprogramed if a change in the threat is detected in operating parameters.

[Deleted.] It is essential to report changed threat parameters immediately so electronic warfare systems can be correctly reprogramed. The longer our electronic warfare ssytems use outdated software programs after parametric changes are detected, the more attrition we will suffer. So reporting is just as essential to successful operations and survivability as collection.

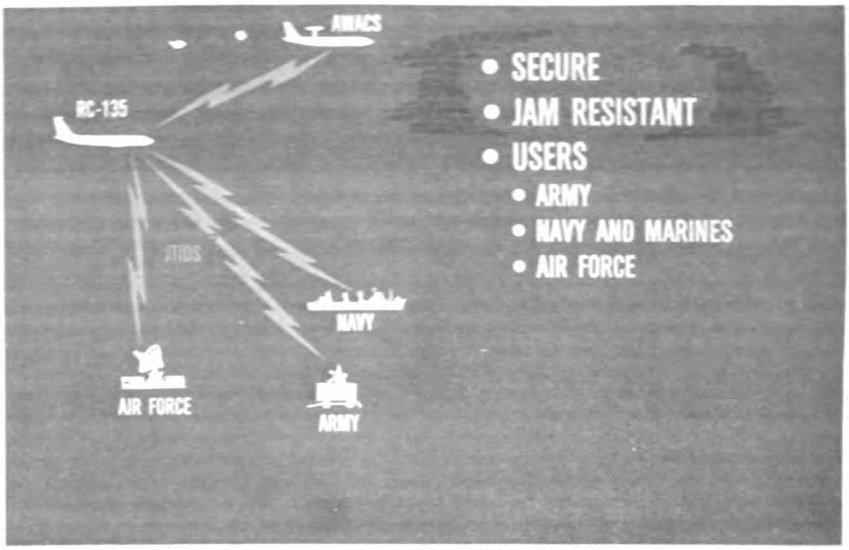
Elint can also provide a timely indication of the overall threat force disposition. Movements can indicate enemy force strengths which a commander might wish to avoid or weaknesses that can be exploited. Based on these indications, missions can be rerouted or canceled, or if necessary, flights in progress can be diverted away from the threat.

The Air Force rivet joint program, [deleted] consists of RC–135V aircraft operated by the Strategic Air Command and manned by SAC and the U.S. Air Force Security Service. The aircraft operate from a main base at Offutt Air Force Base, Nebr., and deploy as required for worldwide coverage. [Deleted.]


RIVET JOINT
FORCE MIX STUDY (NSA/AIR FORCE)
• DIRECTED BY SECDEF
• COMPLETED – SEPTEMBER 76
• TOTAL SIGINT REQUIREMENT
• MOST EFFECTIVE AND EFFICIENT MIX
• CONCLUSION
• [redacted] MODERNIZED RC-135 AIRCRAFT

Colonel WILLIAMSON. In August 1976, a SECDEF program decision memorandum directed NSA and Air Force to determine the optimum force mix to provide acceptable Sigint support to combat commanders.

Digitized by Google



General AHERN. For the Rivet Joint program?
Mr. CROMWELL. For the Rivet Joint.
[The information follows:]

The funding profile for the Rivet Joint modification program is:

Rivet Joint Procurement Funds

Fiscal year:	*Thousands*
1977	$35,720
1978	30,283
1979	21,484
1980	6,403
1981	3,700
1982	3,700

[Deleted.]

EP–3E PROGRAM

Commander HAGEN. The mission of the fleet air reconnaissance squadrons, VQ, is to conduct [deleted] support measures. In carrying out this mission, these commands are able to provide [deleted] the force commander with data on these evolutions.

[Deleted.]

The land-based mission of the VQ squadron is performed by the EP–3E, [deleted] aircraft [deleted] supporting each the Pacific and Atlantic Fleets. EP–3E operations are conducted from forward area basing [deleted]. Squadron detachments routinely conduct ocean area missions [deleted]. VQ is operational at all times [deleted].

The mission success of the EP–3E can be attributed to its equipment configuration.

[Deleted.]

Digitized by Google

MISSION AVIONICS DESCRIPTION (EP-3E)

FREQUENCY COVERAGE

DELETED

FEATURES

DELETED

R D POSITION – PRECISION TEST/MEASUREMENT EQUIPMENT

ALL POSITIONS – SOLID STATE DESIGN

The EP-3E capability is enhanced by unique equipment [deleted]. All EP-3E aircraft [deleted].

Looking to the future, the single greatest factor having large impact upon the mission capability of the EP-3E Aries aircraft is [deleted] provide a well-rounded system geared to the threat of the 1980's. Meanwhile, in its present configuration, the EP-3E remains a vital element in satisfying fleet needs [deleted].

That concludes my statement.

POTENTIAL USE OF AEELS

Mr. CROMWELL. Is the rivet joint AEELS system adapted to the EP-3E, or usable on it?

Commander HAGEN. Yes, sir, I believe it would be. To my knowledge, I am not aware that Navy has taken a position to acquire that system, and at the present time we are defining that by operational requirements for the Elint update.

Mr. CROMWELL. Well, as you take this look, are you going to also see if the AEELS will fulfill your requirements?

Commander HAGEN. Without question, it will be done, yes, sir.

The problem that you might get into in that regard, if you can do a black box swap acquisition for position, it may be simpler to replace components rather than to replace an entire assembly.

Mr. CROMWELL. OK.

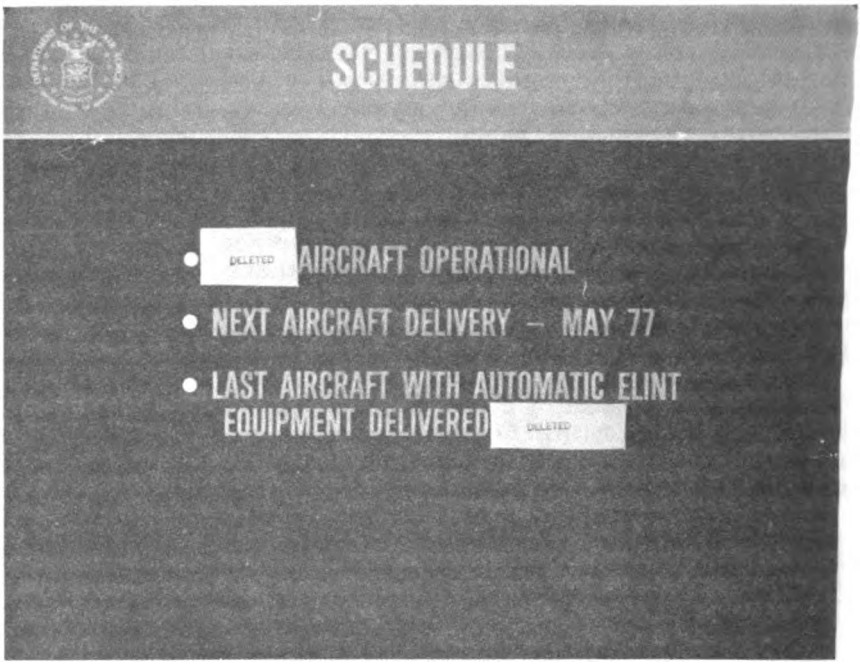
EP–3E PROGRAM PLANNING

Is the current planning going to continue the [deleted] EP-3E's out into the future?

Commander HAGEN. Yes, sir, and that again I suspect will continue until the aircraft is no longer able to fly, into the [deleted] perhaps.

Digitized by Google

[Deleted] modernized Rivet Joint aircraft were part of the overall mix of forces recommended by the study.


SCHEDULE
• [deleted] AIRCRAFT OPERATIONAL
• NEXT AIRCRAFT DELIVERY – MAY 77
• LAST AIRCRAFT WITH AUTOMATIC ELINT EQUIPMENT DELIVERED [deleted]

The Air Force is currently operating [deleted] RC–135V aircraft. The next delivery is in May 1977. [Deleted] RC–135V with an automatic Elint system will be delivered.

Three SAC Elint operators are located in the forward reconnaissance area.

One crewmember operates the automatic Elint emitter location system we call AEELS. The system automatically scans the frequency spectrum [deleted]. The two manual stations are normally tasked to detect anomalies or changes in operating parameters. These changes are the type I discussed earlier which would be used to reprogram EW software.

The automatic system shown here intercepts an emitter [deleted].

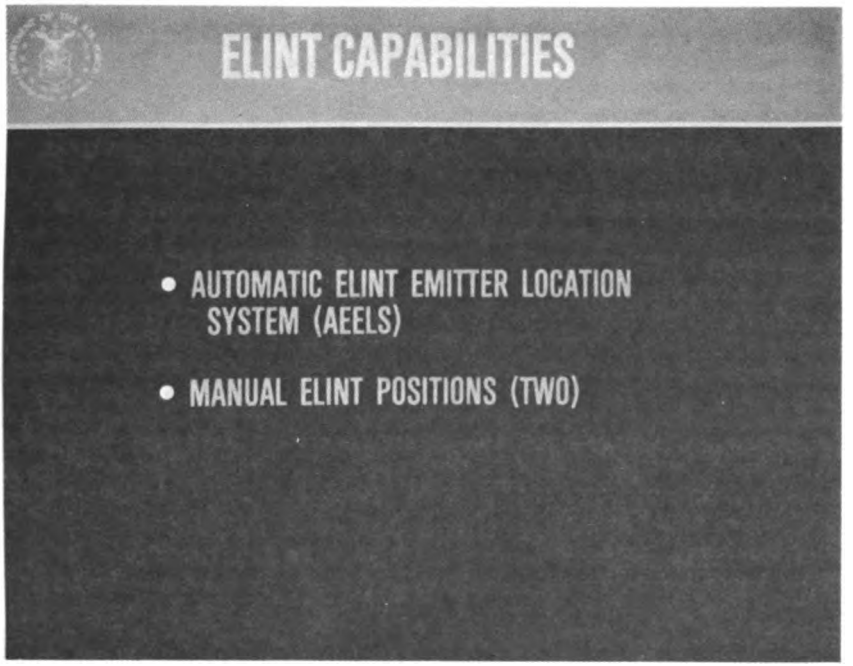
This shows the manual and automatic positions. The manual stations use receivers which are able to select particular emitters identified, either by the automatic operator or tasking, for more precise measurements. Since the automatic system must scan through a wide band of frequencies, it doesn't spend much time on any one frequency. If it did, it would take too long to cover the entire band. The manual positions provide the flexibility to dwell longer on a particular emitter frequency for such characteristics as antenna scan.

Identified priority emitters can be downlinked to in-theater users. The onboard system has already processed the data and provides it in a usable form to the ground station. The ground station, equipped with communications equipment, transmits the reports to various tactical users. Concurrently the system is processing all received

Digitized by Google

emitters, not just priority threats. After the collection portion of the mission, and while the aircraft is en route to its recovery base, a paper tape is punched so that on landing, the crew can deliver the tape to the local communications center for transmission to both theater and national users.

[Deleted.] The TACS is the organization I spoke of earlier, which would redirect in-progress missions away from high threats.



We plan to install the Joint Tactical Information Distribution System, JTIDS, on the Rivet Joint, once that program is approved. This will provide a jam-resistant link to combatant commanders from all services, thus allowing Rivet Joint to be more responsive to the Elint requirements of all theater users.

FUNDING FOR RIVET JOINT

Mr. CROMWELL. Will you provide for the record the year-by-year funding profile associated with this program?

Colonel WILLIAMSON. Yes, sir, I can. The funding was expressly omitted in the past. We were told not to provide that. I have the information. [Deleted] here, so it is not recognizable that way.

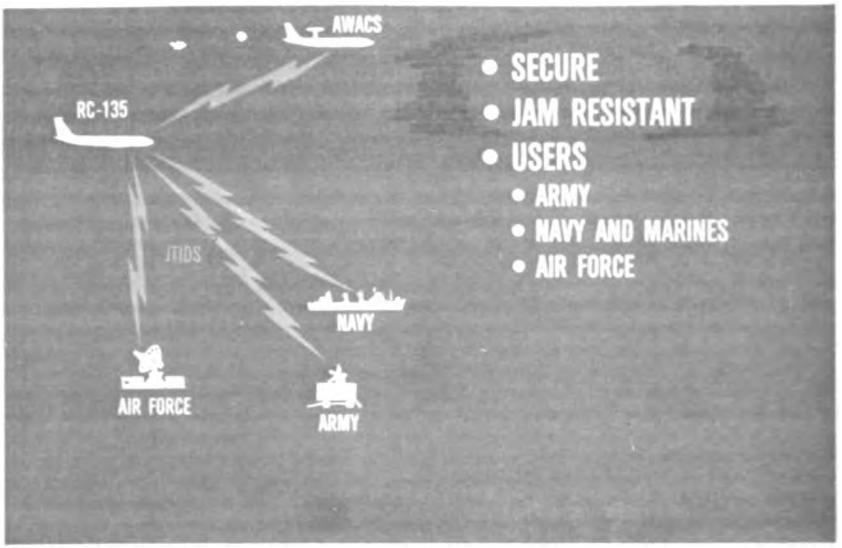
General GREENLEAF. But you can give the Rivet Joint program.

Colonel WILLIAMSON. Yes, sir, I can give the Rivet Joint at this time. [Deleted.]

Mr. CROMWELL. All right, if you will supply for the record funding in that aircraft modification.

Colonel WILLIAMSON. Yes, sir.

Digitized by Google



General AHERN. For the Rivet Joint program?
Mr. CROMWELL. For the Rivet Joint.
[The information follows:]

The funding profile for the Rivet Joint modification program is:

Rivet Joint Procurement Funds

Fiscal year:	*Thousands*
1977	$35,720
1978	30,283
1979	21,484
1980	6,403
1981	3,700
1982	3,700

[Deleted.]

EP-3E PROGRAM

Commander HAGEN. The mission of the fleet air reconnaissance squadrons, VQ, is to conduct [deleted] support measures. In carrying out this mission, these commands are able to provide [deleted] the force commander with data on these evolutions.

[Deleted.]

The land-based mission of the VQ squadron is performed by the EP-3E, [deleted] aircraft [deleted] supporting each the Pacific and Atlantic Fleets. EP-3E operations are conducted from forward area basing [deleted]. Squadron detachments routinely conduct ocean area missions [deleted]. VQ is operational at all times [deleted].

The mission success of the EP-3E can be attributed to its equipment configuration.

[Deleted.]

Digitized by Google

	Fiscal year 1978		Fiscal year 1979		Total	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
APN–5 procurement	1	$3,001	1	$1,985	2	$4,986
APN–5 installation	(1)	725	(1)	776		1,501
Total APN–5		3,726		2,761		6,487
APN–6 spares		407				407

4. Following is the total obligational authority for VQ squadrons. These figures represent cost of manpower and operation of [deleted] aircraft.

	Fiscal year—				
	1978	1979	1980	1981	1982
MPN	15.039	15.752	16.058	16.080	16.090
O. & M.N	13.723	15,225	16.296	16.624	16.977
Total TOA	28.762	30.977	32.354	32.704	33.067

Commander HAGEN. I will be followed by Captain Wright with TASES.

TASES PROGRAM REVIEW

Captain WRIGHT. Good morning. I am the Deputy Project Manager for Airborne Reconnaissance and Electronic Warfare Systems.

TASES, Tactical Airborne Signals Exploitation System, is being developed to provide tactical ocean surveillance and force projection support to the officer in tactical command. This tactical mission is especially important for task force operations in a threat environment where air, surface, and subsurface weapons systems are increasing in sophistication and long-range effectiveness. Almost all of these threat platforms [deleted] to achieve their mission objectives.

TASES is being developed to provide that portion of information which the tactical commander requires but which is not available from other sources [deleted]. Being carrier based, TASES is an organic asset of and directly responsive to the OTC wherever he deploys.

TASES is a flexible system, responsive to tactical redirection. It will have a [deleted]. Its higher sensitivity enables it to [deleted]. TASES is also designed to cope with and be effective in [deleted] and to correlate the intercepted data from multiple onboard sensors.

Computer controlled electronic and communication intercept systems [deleted].

This link can be either direct, when within UHF distance, or via an airborne relay for those missions requiring longer range operations.

TASES will be produced under a three-phase program. Phase 1 currently in progress, is to develop a feasibility demonstration model, or FDM. An S–3 aircraft will be modified by incorporating and integrating [deleted] to validate the concept of TASES. This phase extends through fiscal year 1979, when after a DSARC II decision the program will enter engineering development. Initial operational capability is scheduled for [deleted] at which time the EA–3B's which have been in the service since 1960 will be retired.

Digitized by Google

Mr. CROMWELL. Would you supply for the record the money involved associated with this program?

Commander HAGEN. Yes, sir.

Mr. CROMWELL. Thank you.

[The information follows:]

1. The [deleted] EP-3 aircraft installations were acquired in four lots. The bulk of development and engineering cost was borne by the initial acquisition of [deleted] EP-3B Batrack versions in fiscal year 1967. Cost data includes aircraft modification, system installation, non-recurring engineering, contractor and government furnished equipment procurement, publications, ground support equipment and systems and aircraft training.

Program	Time frame	Quantity	Cost (millions)	Deployed sites
EP-3B Batrack	Fiscal year 1967	2	$17.0	[Deleted.]
EP-3E Aries	ORC 70-15, fiscal year 1970	1	5.88	
Do	ORC 71-10 fiscal year 1971	2	10.46	
EP-3E Deepwell	Fiscal year 1972	7	43.2	
Total		12	76.54	

2. Modification of EP-3E aircraft fiscal year 1978:

Board of Inspection and Survey Trials and Fleet operational use of the EP-3E weapon system, comprised of Elint and Comint subsystems have identified significant deficiencies in the performance and reliability of some electronic equipments. [Deleted.] The required changes have been designed and are available from original equipment manufacturer suppliers.

This procurement is to retrofit all EP-3E Aries/Deepwell aircraft. No development is required. Nonrecurring engineering costs are included to affect equipment modifications and aircraft installation.

Project financial plan:

	Fiscal year 1978		Fiscal year 1979		Fiscal year 1980		Total	
	Quantity	Cost	Quantity	Cost	Quantity	Cost	Quantity	Cost
APN-5	10	$13,218					10	$13,218
O. & M.N. installation			(5)	$788	(5)	$788		1,576
APN-6		2,480						2,480
Total								17,274

3. Modification of EP-3B aircraft fiscal year 1978:

The service life of the EP-3B inventory of [deleted] aircraft is predicted to expire [deleted] based upon current operational flight hour utilization and fatigue life projections of the basic airframe structure. This expiration of aircraft service life is mandatory unless rework of the basic airframe and wing structure is undertaken to extend its useful service life (Service Life Extension Program—SLEP). Further, the EP-3B weapons system, comprised of Elint and Comint subsystems, was procured and installed in the aircraft in fiscal year 1967 using off-the-shelf government-furnished equipments. These equipments are significantly less capable of meeting operational requirements than those state-of-the-art equipments installed [deleted]. The equipment is less reliable, it is heavier by a ratio of 2:1, and imposes the additional maintenance burden and logistics support costs of supporting equipment not common to the EP-3E.

SLEP of the EP-3B fuselage, wing structures and main landing gear is required to extend its service life to the fiscal year 1990/1996 time frame. Replacement of obsolescent avionic equipments with EP-3E avionics subsystems is required to provide essential performance/reliability/maintainability requirements now available in the EP-3E.

Project financial plan:

Digitized by Google

	Fiscal year 1978		Fiscal year 1979		Total	
	Quantity	Cost	Quantity	Cost	Quantity	Cost
APN–5 procurement	1	$3,001	1	$1,985	2	$4,986
APN–5 installation	(1)	725	(1)	776		1,501
Total APN–5		3,726		2,761		6,487
APN–6 spares		407				407

4. Following is the total obligational authority for VQ squadrons. These figures represent cost of manpower and operation of [deleted] aircraft.

	Fiscal year—				
	1978	1979	1980	1981	1982
MPN	15.039	15.752	16.058	16.080	16.090
O. & M.N	13.723	15,225	16.296	16.624	16.977
Total TOA	28.762	30.977	32.354	32.704	33.067

Commander HAGEN. I will be followed by Captain Wright with TASES.

TASES PROGRAM REVIEW

Captain WRIGHT. Good morning. I am the Deputy Project Manager for Airborne Reconnaissance and Electronic Warfare Systems.

TASES, Tactical Airborne Signals Exploitation System, is being developed to provide tactical ocean surveillance and force projection support to the officer in tactical command. This tactical mission is especially important for task force operations in a threat environment where air, surface, and subsurface weapons systems are increasing in sophistication and long-range effectiveness. Almost all of these threat platforms [deleted] to achieve their mission objectives.

TASES is being developed to provide that portion of information which the tactical commander requires but which is not available from other sources [deleted]. Being carrier based, TASES is an organic asset of and directly responsive to the OTC wherever he deploys.

TASES is a flexible system, responsive to tactical redirection. It will have a [deleted]. Its higher sensitivity enables it to [deleted]. TASES is also designed to cope with and be effective in [deleted] and to correlate the intercepted data from multiple onboard sensors.

Computer controlled electronic and communication intercept systems [deleted].

This link can be either direct, when within UHF distance, or via an airborne relay for those missions requiring longer range operations.

TASES will be produced under a three-phase program. Phase 1 currently in progress, is to develop a feasibility demonstration model, or FDM. An S–3 aircraft will be modified by incorporating and integrating [deleted] to validate the concept of TASES. This phase extends through fiscal year 1979, when after a DSARC II decision the program will enter engineering development. Initial operational capability is scheduled for [deleted] at which time the EA–3B's which have been in the service since 1960 will be retired.

Digitized by Google

During the FDM phase, one S–3A is being modified to a TASES configurition by removing pure ASW equipment and integrating [deleted] with embedded S–3A radar, navigational communication, FLIR, computer, display, and software equipments. During the feasibility demonstration, a bare-bones system will be developed to prove the concept by demonstrating solutions of critical issues. This demonstration will be an evolutionary process. It will start wtih laboratory tests of subsystem components, system tests within the laboratory, ground tests on the aircraft, and then with a flight test. Computers and simulators will be used to test the capability of the TASES to rapidly [deleted].

After the laboratory tests, we have ground tests and then a flight test phase which would be conducted by the contractor and by the Navy, on Navy and national ranges, culminating with fleet exercise participation.

PROGRAM TECHNICAL RISKS

- HARDWARE
- SOFTWARE/INTEGRATION
- ELECTROMAGNETIC INTERFERENCE (EMI)
- FOUR MAN CREW CONCEPT

One of the technical risks we have is in trying to put this system in a small aircraft. We looked at the hardware risks. We have attempted to avoid hardware risks through very conservative design techniques. We are using off-the-shelf systems to a great extent. We are using state of the art technology and repackaging systems and components from other systems.

In the EMI, elecromagnetic interference area, the S–3A has EMI characteristics which do not affect the ASW mission, but do have the ability to adversely affect TASES with its much higher [deleted]. Also we are going to be using data transmission and simultaneous voice, which calls for design and installation methods to insure primary [deleted] functions are not degraded.

We have run an EMI profile on an S–3. We do know what the existing EMI problems are. We are making fixes and corrections for those in the feasibility phase, and we are increasing the mil-spec requirements on shielding to prevent additional interference from those equipments that are installed.

Software integration is a problem in a complex system, being able to operate and provide effective tactical support in a [deleted]. Proc-

Digitized by Google

essing becomes a key element in order to insure [deleted] are disregarded and [deleted] receive priority processing without saturating the operator. Software development, integration, and testing is being designed and closely monitored to insure proper structuring for effective system operation.

The four-man crew concept is a concern. A valid concern is whether three operators and a pilot can cope with the anticipated environment. The approach to this risk area includes close Navy man-machine team interface with the contractor; a high degree of system automation; operation aids; and a thorough test program.

In summary, TASES is required to provide organic, immediately responsive ESM support to the OTC wherever he may operate. The program as it is being pursued permits a hands on, operational assessment of the concept, ultimate equipment requirements, and technical approach at minimum cost, prior to full-scale development.

That concludes by briefing.

TASES BUDGETING PROGRAM

Mr. CROMWELL. Is there a fiscal 1978 budget request for the TASES?

Captain WRIGHT. Yes, sir; there is.

Mr. CROMWELL. Did you present it?

Captain WRIGHT. I will provide it for the record.

Mr. CROMWELL. And would you supply the total funding of the TASES program?

Captain WRIGHT. Yes, sir.

Mr. CROMWELL. That would be R. & D. and estimated carryout.

Captain WRIGHT. Yes, sir.

[The information follows:]

ESTIMATED TASKS PROGRAM COSTS

[In fiscal year 1977 dollars]

	1976/ transition quarter/ 1977	1978	1979	1980	1981	1982	1983–85	Total
R. & D. FDM	30.0	15.4	8.6					54.0
R. & D. EDM			2.5	35.2	19.3	4.1		61.1
R. & D. shipboard terminal	.2			4.0	7.5	2.0		13.7
APN-1[1]					119.9	119.9		239.8
APN-5[1]						61.3	[Deleted.]	
APN-6						8.0		
OPN						5.4		
FMP								
Totals by year	30.2	15.4	11.1	39.2	146.7	201.7	201.3	644.6

[1] Figures subject to readjustment based on economic analysis of installation method of TASES equipments.

CURRENT EA–3B PROGRAM

Mr. CROMWELL. And what is the current aircraft the Navy uses off the carriers for this role?

Captain WRIGHT. They currently use the EA–3B, the version of the Douglas heavy attack bomber. As I said, it has been in service since approximately 1960.

Digitized by Google

Mr. CROMWELL. How many of those does the Navy have at the present time?

Captain WRIGHT. I believe they have [deleted] in inventory.

Mr. CROMWELL. What is the expected lifetime of the EA–3B?

Captain WRIGHT. The current phaseout schedule is concurrent with the introduction of TASES [deleted].

Mr. CROMWELL. In prior years as the Navy was trying to start the TASES program, we were told the EA–3B's would run out of service life in 1978 or 1979. Has there been a structural update program to extend the life?

Captain ECKART. Sir, I believe I can answer that question. The present plan is to continue the EA–3B out through 1985. Now, to do that we have run sort of a continuing program of what we call service life extension on various critical components of the aircraft. We finished one life extension program which increases the wing life on aircraft which was an original limiting factor. We are in the process, as aircraft reach limits on arrest landing and catapult take-off from the carrier, we are replacing some of the suport structures in the aircraft, and this will then allow us to extend the aircraft for a given number of either landings or take-offs.

So our present planning indicates with selective extension programs of that sort, that we can operate the aircraft out to 1985, until the TASES aircraft is operational.

Mr. CROMWELL. And how much is that going to cost?

Captain ECKHART. I would have to supply that for the record.

Mr. CROMWELL. If you would.

[The information follows:]

EA–3B Selective extension program

	Thousands
Wing residual stress analysis (MDC)	210
Wing life AFC 477 (kits available): (*a*) Installation (5 at 60M)	300
Catapult structure:	
(*a*) MDC study	30
(*b*) Keel replacement (11 at 50K)	550
Arrest structure (AFC455):	
(*a*) Kits (7 at 25K)	175
(*b*) Installation (May still have to restrict carrier OPS in mid-80 for some A/C because of high usage) (7 at 15K)	105
Horizontal stabilizer:	
(*a*) Study MDC	15
(*b*) Stabilizer rework (14 at 6.4K)	90
Vertical stabilizer:	
(*a*) Study MDC	15
(*b*) Fin stub rework (14 at 28.5)	399
LDG shock struts (14 at 67)	938
NLG retract links (14 at 0.64)	9
	2,836

NOTE.—Known problem areas only. Assumes all installations concurrent with scheduled depot level maintenance (SDLM).

SOURCES OF TASES AIRPLANES

Mr. CROMWELL. The annual question that comes up on TASES is where are you going to get the S–3 airframes from?

What is this year's answer?

Digitized by Google

Admiral MANDEVILLE. You know, we are supposed to go back to OSD in 1979 when we have finished the feasibility demonstration model work to discuss platform with him, and it is tied in part to their deliberations over there, as far as the S–3 line, the TASES platform is certainly a part of that discussion as we are working the 1979 POM. But if we had made a decision today, we really are obligated to wait until we finish this to have a dialog with OSD and get their concurrence on the chosen platform.

Mr. CROMWELL. What is the situation on S–3 platforms? Isn't there an attrition problem sometime in the 1980's?

Admiral MANDEVILLE. Yes, sir, this is a problem that we are facing, as I say, right now in our 1979 POM preparation process, the attrition S–3 buys as well as S–3 platform candidates for the TASES.

Mr. CROMWELL. In what fiscal year do you run out of current S–3's and need to have new production?

Admiral MANDEVILLE. It is in the early 1980's. I believe it is around 1983.

Mr. CROMWELL. Would you supply for the record the figures that show the annual projected deficit of S–3 platforms with and without a TASES platform?

Admiral MANDEVILLE. Yes, sir, will do.

[The information follows:]

ANNUAL PROJECTED DEFICIT OF S–3 PLATFORMS

	1983	1984	1985	1986
With TASES	2	15	29	47
Without TASES			11	28

Mr. CROMWELL. Thank you, Captain.

Captain WRIGHT. Thank you.

GAO REPORT ON EF–111

Mr. CROMWELL. I have a question for the record on the EF–111. The GAO report on the EF–111 stated a number of technical deficiencies when they would encounter certain enemy threat radar capabilities.

Would the Air Force supply a point-by-point statement of whether the—first of all, whether they believe that the reported deficiency is valid, and second, how they will handle it, or if they can't handle it, where they can't handle it.

General AHERN. Yes, sir, we will.

[The information follows:]

The GAO stated deficiencies/uncertainties with regard to the EF–111A's jamming effectiveness against specific Soviet Union radars are listed below, followed by the Air Force's position.

Deficiency.—The ALQ–99 system may not always detect radars which operate at pulse repetition frequencies of less than [deleted] pulses per second.

Position.—Concur with GAO comment as stated. However, serious degradation in the automatic jamming mode does not occur until below about [deleted] PPS. Intelligence information indicates that only one non-obsolete USSR/Warsaw Pact generic radar falls in this category [deleted]. The probability of detecting the [deleted] is calculated to be [deleted] in three scans. This is not considered

Digitized by Google

a serious problem, as most radars in this category are low frequency, long range and can be adequately countered with [deleted] jamming.

Deficiency.—Some enemy radars use techniques (countermeasures) which could prevent the EF-111A from identifying them.

Position.—Concur with GAO statement. It is true that the EF-111A has limited support jamming capability against some Soviet radars. It has not been designed to counter some Soviet [deleted]. The EF-111A is not intended to counter all of the Pact threat alone. It must be treated as part of a tactical "mix" of jammers, antiradar weapons, and decoys which augment each other, each countering certain parts of the enemy air defense very well.

Deficiency.—A reported modification to the Soviet [deleted] surveillance radar to improve its adverse weather performances could reduce EF-111A jamming effectiveness against that type of radar.

Position.—Concur with GAO statement. However, analyses indicate that degradation of EF-111A effectiveness due to this capability should be minimal. A flight test is planned in August-September 1977 time period on a [deleted] to validate this assessment.

Deficiency.—It is reasonable to assume that by 1981 many Soviet Union radar changes will occur with possible impact on EF-111A effectiveness.

Position.—Concur with GAO comment. Future changes in the electronic warfare threat may introduce radars that the EF-111A as currently programmed will not counter. Electronic warfare programs are sensitive to technology changes and must keep pace to be effective. The present capability and future potential of the EF-111A will be assessed by ground/air testing and analysis, using simulation models, prior to a production decision by the DSARC process.

Deficiency.—The Soviet Union has [deleted] radars which cannot be jammed by the ALQ-137 due to one or more of the following deficiencies: Frequency limitation of [deleted] megahertz may be insufficient to jam new Soviet Union radars; limited or no capability to jam [deleted] radars such as the [deleted] radar; inflexibility of techniques to adequately jam [deleted].

Position.—Concur with GAO statement. The DOD assessed the ALQ-137 to be the most cost-effective candidate for application to the EF-111A at the time of program formulation. Other protection capabilities peculiar to the EF-111A such as the ALQ-99, ALR-62 and MIG CAP are expected to provide an adequate self-protection capability. D.T. & E./I.O.T. & E. will assess the adequacy of the overall self-protection capability prior to a production decision.

Mr. CROMWELL. Are we ready for the Army now?

General CANEDY. Yes, sir, we are down to the Army.

Mr. CROMWELL. OK. I would like to do two things. There is a very fine Army concept of operations briefing, but in view of the time and since the Senators have left could we insert that in the record.

General CANEDY. Certainly.

Mr. CROMWELL. And also, if Air Force and Navy witnesses would like to be excused, I will just leave it up to yourselves.

General AHERN. I appreciate your consideration, sir, but we will stay and support our Army friends.

Mr. CROMWELL. Fine.

[The prepared statement of Lt. Comdr. Richard W. Mock on the Army concept of operations briefing follows:]

ARMY EW CONCEPT OF OPERATIONS

Mr. Chairman, gentlemen, I am LTC Richard Mock from requirements Directorate of the Office of the Deputy Chief of Staff for Operations and Plans, HQDA. The overall classification of this presentation is secret.

My presentation will cover electronic warfare in the United States Army, with emphasis on electronic intelligence and jammer programs as they relate to close

Digitized by Google

air support operations. A representative number of individual systems being procured in the Army program will be covered in detail during the presentation.

Before proceeding with the main theme, allow me to place Army electronic warfare in proper prospective. The Army is unique among the services for its concept of electronic warfare operations. The functions of signal intelligence and electronic countermeasures are fully integrated at the lowest operating level.

[Deleted.]

Army EW supports all tactical forces in the offense and defense. It is a major weapon for the tactical commander. The requirement for responsiveness to support undermechanized ground units is the driving force behind the Army EW concept. We feel that many of the targets will be targets of opportunity, the type that require instantaneous decision and action on the part of an operator at the lowest tactical echelon.

The requirement for our electronic warfare systems derives, in large part, from the basic fact that in a war in Europe we would be opposing a sophisticated Soviet force that enjoys a substantial numerical superiority and which relies on electronics for command, control and weapons system support.

MILITARY REQUIREMENT

WE MUST:

- EMPLOY WEAPONS AND FORCES BETTER THAN THE ENEMY.
- REDUCE ENEMY'S CAPABILITY.

EW SYSTEMS ENABLE US TO:

- "SEE" THE BATTLEFIELD AND TAKE ACTION.
- DENY OR DEGRADE ENEMY CAPABILITY.
- SHIFT BALANCE OF COMBAT POWER.

We must reduce the enemy's ability to maneuver and direct his weapons. EW systems are unique in their ability to see and respond to a highly mobile battlefield in real time—to deny the enemy's ability to do the same—and thereby shift the balance of combat power.

The Soviet concept for electronic warfare, known as radio electronic combat, is quite clear in its objectives.

[Deleted.]

The Soviet electronic target is portrayed on this viewgraph. This overlay depicts current U.S. Army capabilities to cover the electronic target, gaps in coverage are readily apparent. The next overlay depicts the capabilities of systems contained in the Army program.

88-379 O - 77 - 17

Digitized by Google

There are certain basic needs relative to the effective employment of Army combat forces which are illustrated here:

BASIC REQUIREMENTS

- LOCATE & IDENTIFY MANEUVER FORCES
- LOCATE & IDENTIFY RADARS
- ISOLATE & BLIND ENEMY FORCES

1. We must be able to rapidly and accurately locate and identify enemy maneuver forces, and continuously keep track of those forces.
2. We must be able to rapidly and accurately locate, identify, and keep track of his radar assisted weapons and surveillance systems for avoidance and targeting. This includes artillery counter mortar/counter battery radars, battlefield surveillance radars and certain air defense weapons systems.
3. We must be able to disrupt his command and control of maneuver forces and his surveillance and target acquisition systems—his ability to see what we are doing.

Our passive systems (systems which listen) provide a unique capability for satisfaction of the first two requirements. Our active EW systems (jammers) are essential to satisfy the third requirement since there is no way that we can provide sufficient lethal weapons to engage all targets by fire.

US/SOVIET COMPARISON

- SOVIETS HAVE FORMIDABLE CAPABILITY TODAY — AND ARE EXPORTING IT . . .
- US ARMY CAPABILITY IS EXTREMELY LIMITED TODAY . . .
- ARMY OBJECTIVE IS TO ATTAIN SUFFICIENCY BY EARLY 1990's.

It has been emphasized in previous briefings that the Soviets have a formidable EW capability which they have successfully integrated into their operational doctrine. Their equipment is rugged, simple to operate, and readily available in

Digitized by Google

sufficient quantities [deleted]. The Army objective is to attain sufficiency by the early 1980's.

[Deleted.] Coupled with their numerical superiority in tanks, guns, and personnel, their electronic warfare forces becomes a formidable weapon.

Electronic Technology is the one area in which the U.S. still maintains a lead of the Soviets. This technological lead must be used explicitly to achieve a multiplier effect on friendly force capabilities in order to partially overcome the Soviet numerical superiority [deleted].

[Deleted.]

With the capability to locate and jam command, control, and weapons associated electronics, the U.S. ground forces can disrupt fast moving armored operations, prevent the enemy from entering a battle at a crucial time or place, and destroy his electronic support systems by location and artillery fire.

Our R. & D. efforts have focused on the manpower and response problems. I will discuss later in the briefing how we have achieved significant increases in capacity and responsiveness in our new systems at no increase in personnel.

Let us first discuss the current capability of the army in the field.

[Deleted.]

Our ground based systems are manually operated, very old, difficult to support, and [deleted].

[Deleted.] In addition, we do not have sufficient equipment for [deleted].

Our current airborne systems by-in-large are left over from Vietnam and not equipped for a [deleted].

Thus, the future systems we will discuss today are, for the most part, not replacements or improvements to an existing capability, they are required to equip the force with a new combat capability for the first time.

Why do we find ourselves in a condition of "catch up" with the Soviets in the EW area.

1. The Soviets have long recognized the value of EW and our vulnerabilities. They have pursued an intensive program to field both a passive and active capability which is redundant in numbers, and with overlapping frequency coverage. They seldom throw anything away! When new equipment is developed using higher frequencies, lower frequency equipment is retained, complicating our intercept and jamming problems.

2. Until recent years, the EW threat to the U.S. ground forces was minimal. R&D and procurement efforts did not, therefore, enjoy a priority sufficient to compete with the Army's needs in other areas.

3. The drawdown from Vietnam resulted in an increased interest on strategic signal intelligence. Personnel and fiscal reductions were taken primarily by the tactical forces in the Sigint/EW area.

What caused the turn around within the Army?

1. The Arab/Israeli war of 1973 saw the first widespread use of ground EW by both forces. This was probably the one most important event which triggered a renewed interest in EW within the Army.

2. The late chief of staff of the Army, General Abrams, primarily from his exposure to Sigint/EW as the Macv Commander in Vietnam, recognized the serious Sigint/EW deficiency within the Army, the growing Soviet EW threat, and a requirement for EW as a weapons system. He, therefore, directed that personnel spaces would be made available to provide direct support EW units to each division in the 16 Division force. Corresponding R&D procurement programs were developed to outfit these units with equipment to meet the ever-growing Soviet threat.

Let us now look at Army vs. Air Force EW doctrine. The forward area ground commander is vitally interested in the situation immediately adjacent to the forward edge of the battle area and the battlefield to a depth which includes enemy second echelon forces. Information gleamed from this geographical area is highly perishable, therefore, a requirement exists for all weather, 24 hour-a-day coverage and rapid dissemination of the product to the lowest echelons. Conversely, the Air Force has a requirement to see into enemy territory to great depths. The perishability of the collected data is not as time critical to the Air Force since the targets are generally more stable.

The very nature of military electronics on the battlefield dictates that the Army and Air Force collection efforts be conducted differently. They are seldom

Digitized by Google

compatible but often mutually supporting. Ground systems are essential to satisfy the Army's all weather, 24 hour-a-day EW requirement in the forward area. In effect, the airborne compent becomes an extension of the ground system. It provides a capability to look beyond terrain barriers and exploit line-of-sight emitters. It increases mobility which enables rapid massing of forces, and it provides continuity whenever ground systems are displacing. Army air and ground systems are now being designed to ensure maximum commonality of components. The ground processors are compatible and/or interchangeable. Army reconnaissance aircraft are low fliers while the Air Force aircraft are normally high flyers.

In essence, the Army's Airborne EW operations take place [deleted]. A relatively low operating altitude is essential while conducting VHF Intercept operations, due to a condition known as co-channel interference. An aircraft flying at high altitudes in rear areas of the combat zone would hear, primarily, the higher powered emissions.

The extended line-of-sight afforded by the higher altitude is essential to exploit deep targets for interdiction, it is not conducive to intercepting the low powered systems which support enemy forward maneuver elements.

Now that we have established the difference between Army and Air Force EW doctrine, let us take a closer look at the concept of EW support to the Army.

[ARMY CONCEPT]

[DEVELOPED FROM THREAT — BASED ON:]

[— ENEMY VULNERABILITIES]

[— PROPOGATION PHENOMENA]

[— ECONOMY OF FORCE]

[— ORGANIC SELF PROTECTION]

[— DIRECT CT TO CDR]

[— COMPONENT OF COMBAT POWER]

The Army concept was developed from the enemy threat we are expected to face. It was based primarily on enemy vulnerabilities to electronic warfare, and the propogation phenomena of battlefield electronics. Other areas of consideration common to any military unit were economy of force, organic self-protection, direct support to the ground commander and an element of combat power.

The Army EW force structure was developed in accordance with the bottom to top philosophy, in other words, the front line units will be equipped first.

The EW force is being tailored to the supported tactical unit. It is designed to provide division level assets for most critical needs. Reinforcing assets or general support at Corps level. Air and ground systems that are complementary, and active and passive systems which complement each other.

Digitized by Google

EW SYSTEMS CAN PROVIDE

- ROUTES OF PENETRATION
- LOCATIONS OF HEADQUARTERS AND CRITICAL INSTALLATIONS
- LOCATIONS OF CAS JAMMERS

Our general support rationale is based where the mission can best be conducted. Organizations and systems will be used in general support when [deleted] or the complexity/cost of the system determines the most economical use and maintenance support. The primary objective of general support is to obtain the best trade-off between cost and operational effectiveness.

GENERAL SUPPORT RATIONALE

- ORGANIZATIONS/SYSTEMS HELD IN GEN SPT WHEN:
  - FREQUENCY/PROPAGATION PERMITS LONG RANGE INTERCEPT
  - COMPLEXITY/COST OF SYSTEM DETERMINES MOST ECONOMICAL USE AND MAINTENANCE SUPPORT
- OBJECTIVE IS BEST TRADE-OFF BETWEEN COST AND OPERATIONAL EFFECTIVENESS

Let us now look at a graphic portrayal of the division or direct support system as envisioned in the Army program. This viewgraph is color coded to indicate equipment function, whether the system is optimized for intercept, locating, jamming or a combination of functions. As you readily see, all of the systems feed into the division operations center located in the center of the viewgraph. [Deleted.] Tasking of EW resources is accomplished in the operations center along with mission management.

[Deleted.] The results of the direct support analytic effort would then be fed into the division tactical operations center outlined by the broken line in the upper right hand corner of the viewgraph. From the DTOC, information will be passed to the Corps and to Air Force intelligence centers.

The operational concept of one direct support system, the jammer mounted in the EH-1H helicopter, is contained on this viewgraph. If you will orient on the line drawn diagonally through the slide, I will describe the operational concept.

Digitized by Google

This line depicts the forward edge of the battle area. Friendly forces are on the left with enemy forces on the right. The heliborne platforms will operate [deleted].

The next viewgraph depicts the general support resources at corps level like the division, all of the systems feed into [deleted]. The corps level is the focal point for all tactical intelligence. Information from Air Force systems would be primarily integrated at the corps where Air Force personnel are working along with Army personnel in the tactical operations center. Information obtained from Army resources would be passed to the Air Force from the corps TOC while technical exchange of information will take place between the FCAC and the Air Force intelligence centers.

As indicated by the lines on the viewgraph, the next slide graphically depicts a crops general support system operating in support of an operation to strike and objective deep in enemy territory. This system operates approximately 40 km to the rear of the FEBA under 10,000 feet. It has been tasked to intercept and locate air defense radars and pass the information to the corps TOC where it is relayed to the divisions on line to enable air defense suppression and penetration of the FEBA by CAS aircraft [deleted]. Locations obtained during this operation would be simultaneously passed, for example, to the attack helicopter.

With this basic understanding of the concept, let us now look at the role of Army EW in close air support.

The EW community has long recognized its inherent ability for target acquisition [deleted]. Our R&D efforts focused on this and other deficiencies and the desirability of being able to locate emitters operating in conjunction with a weapons system in a timely manner [deleted].

Although our radar intercept systems were designed primarily to [deleted].

Recognizing that a combined Army/Air Force suppression effort will be required if we are [deleted]. The systems can also provide possible routes of penetration and egress from enemy territory and provide the ground commander with possible [deleted] coupled with the passive effort to accurately locate air defense forces is our active communications/jamming capability, both ground and airborne, which can be tasked to exploit his air defense command and control communications. EW also has the capability to locate enemy [deleted].

LTC Hegerich from the Office of the Deputy Chief of Staff for Research, Development and Acquisition will now cover representative systems in R&D and procurement during 1978 which will fill current gaps and improve our capability to handle the large volume of data created by a dense signal environment.

NEW SYSTEM CAPABILITIES

RAPID SCAN, IDENTIFY, LOCATE

REMOTE TUNING

COMPATIBILITY

The systems discussed all incorporate the capability to [deleted] thus increasing our productivity with less personnel. All ground terminals will have the capability of accepting data from Navy or AF systems.

During the past several minutes, I have provided an insight into the Army EW program, which comprises one of the most needed and [deleted]. Electronic warfare is a third element of combat power, in conjunction with fire and maneuver it can tilt the balance of relative combat power on the battlefield. Although not specifically designed to do so, EW can contribute significantly to the success of close air support operations. A detailed analysis of the [deleted].

Digitized by Google

DEFINITION

ELECTRONIC COUNTER-COUNTER MEASURES-

Actions taken to insure friendly use of the electromagnetic spectrum despite the enemy's use of Electronic Warfare.

Now that we have covered the Army's current and future capability for offensive electronic warfare, let us take a few minutes to discuss ways and means to combat Soviet EW activities, commonly known as electronic counter-countermeasures or ECCM.

Advancing technology continually contributes to the development of new electronic countermeasures or ECM. Like ourselves, the potential enemy is equally busy developing devices to countermeasure our ECM. In peacetime, the R&D and intelligence communities devote a considerable about of resources to determining new ECM features and developing ECCM circuitry in an effort to defeat or degrade the enemy efforts. I will not dwell on this aspect of EW, but would like to briefly discuss procedural methods employed by our troops in the field, effective use of which often spells the difference between being able or not being able to communicate.

HUMAN ORIENTED ELECTRONIC COUNTER COUNTERMEASURES (ECCM)

PLANNING BY COMMANDERS

- *Terrain masking*
- *Manipulative deception*
- *Communications discipline*
- *Standing operating procedures*

OPERATOR TRAINING

- *Countermeasures recognition*
- *Counter counter measures actions*
- *Antenna siting*
- *Good communications practices*

Digitized by Google

Our tactical EW units who will perform active and passive EW operations during a conflict, are in peacetime busily engaged in training our ground forces in defense against EW. Unit training tests, maneuvers, and exercises all incorporate live jamming and personnel from the commander to the individual soldier are being trained in correct procedures—as depicted on this viewgraph. These measures, coupled with learning to operate under radio silence, reducing transmission time, and using alternate means of communication, do not defeat jamming but they do reduce the effectiveness of enemy EW and allow our maneuver elements to carry out their mission in an EW environment.

Gentlemen, this concludes my presentation.

General CANEDY. OK. As you know, Mr. Cromwell, we restructured this presentation to include the concept which you have had which tied it in from the hearing on Wednesday, I believe it was, and we have isolated five systems to present here this morning.

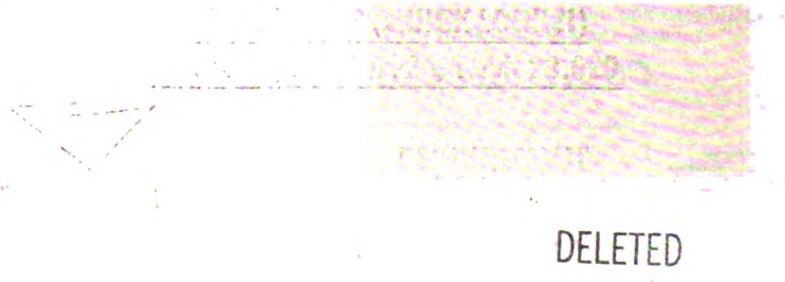
Lt. Col. Bob Hegerich will present those systems now.

ARMY ELECTRONIC WARFARE/INTELLIGENCE SYSTEMS

Colonel HEGERICH. Sir, I am Lieutenant Colonel Hegerich from the Office of the Deputy Chief of Staff for Research, Development, and Acquisition, and I will be describing five of the Army's tactical electronic warfare and intelligence systems today.

QUICK LOOK II

The first system I would like to discuss is the AN/ALQ–133 or Quick Look II system [deleted]. The system is mounted in an RV–1D Mohawk Army aircraft [deleted].



DELETED

DELETED

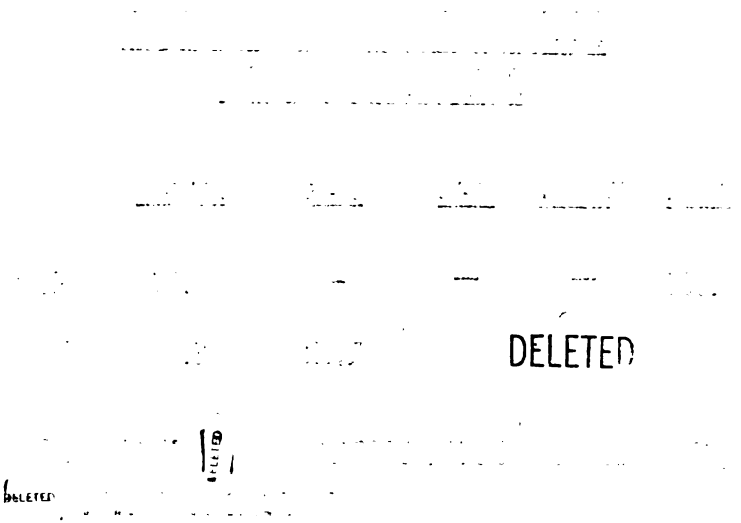
DELETED

DELETED

Digitized by Google

This viewgraph is a short summary of the Quick Look II program. [Deleted].

As is shown by the schedule [deleted].



Shown on the next viewgraph are the program costs in R.D.T. & E. and procurement. Our current plan is to procure [deleted] Quick Look II systems. This number will equip [deleted]. This concludes my briefing on Quick Look and I would now like to address the Agtelis system.

QUICK LOOK LOCATION PROCESS

Mr. CROMWELL. Could you, before you go on, tell me how you manage to [deleted].

Colonel HEGERICH. Yes, sir. It is a [deleted].

Mr. CROMWELL. Well, technically is it a [deleted] process?

Colonel HEGERICH. Yes, sir, it is a [deleted] process. What it does is as [deleted].

Mr. CROMWELL. As long as the emitter stays on.

Colonel HEGERICH. As long as the emitter stays on; yes, sir.

Mr. CROMWELL. That sounds like a higher degree of accuracy than [deleted] any other system we have heard of.

Colonel HEGERICH. I don't believe so, sir.

Mr. CROMWELL. Anyway, you could check that for the record.

Colonel HEGERICH. Yes, sir, we will check that for the record.

[The information follows:]

A comparison of Army, Navy and Air Force [deleted] systems shows that, in general, system accuracies are similar for systems which have similar applications. In the case of Army Quick Look and Air Force Tactical Electronic Reconnaissance TEREC systems, both are designed to [deleted]. A comparison of these systems to Navy systems is more difficult since Navy systems perform a somewhat dissimilar function.

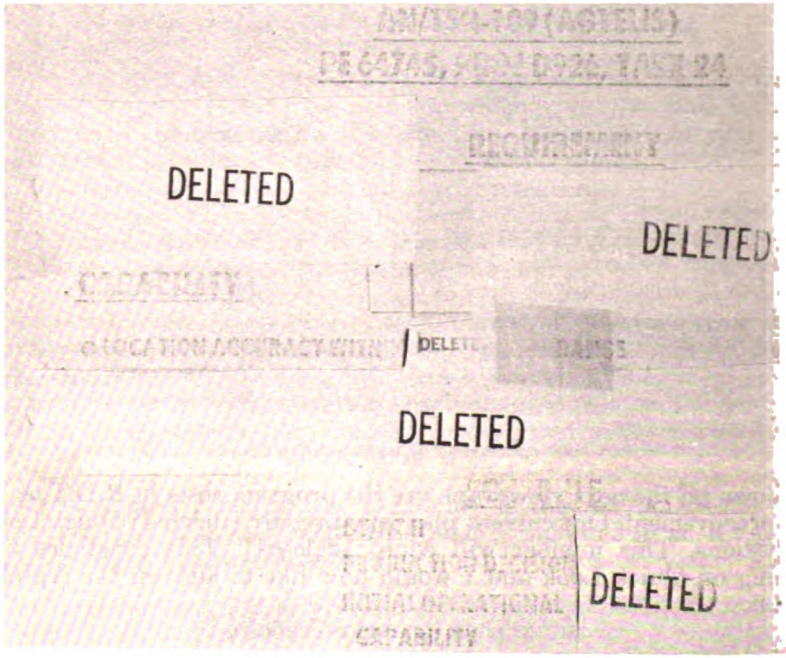
In the Navy EA-6B, the [deleted]. The Navy E-2C and TASES programs are oriented towards [deleted] and there is no equivalent Army system against which to make a reasonable comparison; E-2C RMS accuracy is [deleted] and, TASES is oriented towards [deleted] rather than [deleted] therefore, it uses a dissimilar antenna system.

Digitized by Google

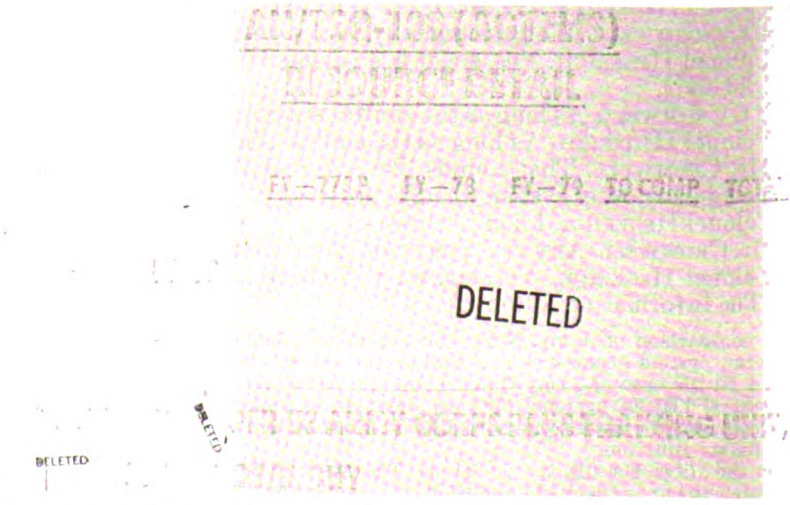
In summary, a comparison shows that like technology is used for like applications with similar results and similar inherent limitations.

Colonel HEGERICH. The AN/TSQ–109 Agtelis system is a truck mounted [deleted].

The Agtelis system is [deleted].



As shown on the viewgraph, Agtelis [deleted].



The next viewgraph shows the anticipated total program costs to develop and buy a total of [deleted] systems. This quantity would equip [deleted].

Digitized by Google

Sir, this concludes my briefing on [deleted] systems, and I would now like to discuss some of our developmental [deleted] systems.

SITE LOCATION

Mr. CROMWELL. Now, a question on Agtelis. How do you site a system, s-i-t-e, site?

Colonel HEGERICH. Well, we would choose pieces of terrain which would be appropriate for [deleted] systems. We would try to get higher terrain so that it would give the systems a better field of view. That is one of the considerations.

Another consideration is that we try to get an adequate baseline. We try to space these things out so that they can [deleted] properly.

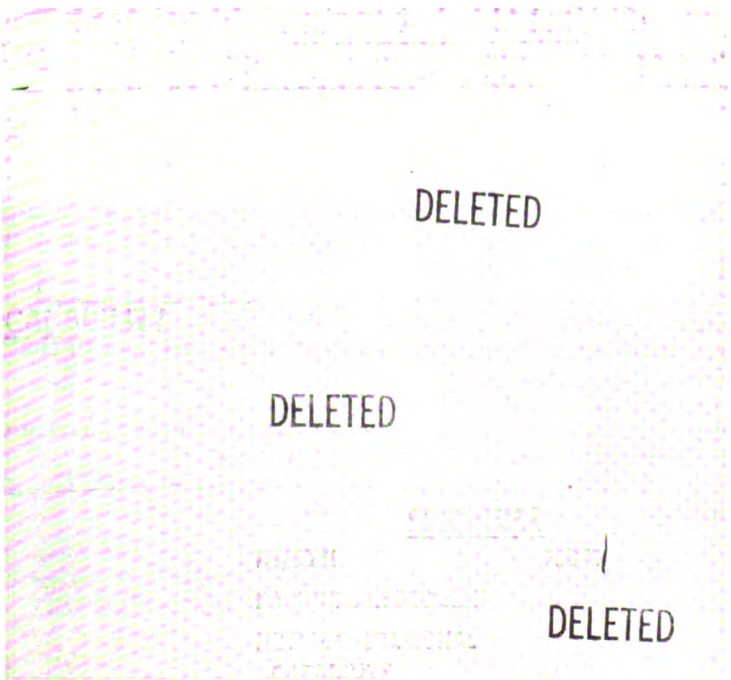
Also another consideration is the communication between the [deleted] which relates to the siting on higher terrain.

Mr. CROMWELL. Now, once you pick your spot on the terrain, how do you navigate, how do you know where you are?

Colonel HEGERICH. In the Agtelis system at the moment, sir, [deleted]. There are, of course, other ways we can do it. Some of our mobile [deleted]. There are some systems, some Army ground navigation systems coming into the inventory which we would use in these systems once they are available.

CEFLY LANCER

The first of these systems which I will now talk about, sir, is the AN/USQ–71 or Cefly Lancer system. This system is being developed by the Army [deleted].



Digitized by Google

As is shown on the viewgraph, Cefly Lancer has [deleted].

DELETED

DELETED

DELETED

As is shown on this next viewgraph, development cost was about [deleted].

The procurement costs shown are for systems to equip [deleted].

Next, sir, I would like to discuss the TACELIS system.

COST OF SYSTEM

Mr. CROMWELL. Before you go into that, that is not an inexpensive program.

Colonel HEGERICH. Yes, sir.

Mr. CROMWELL. Do you know the reason for this? Where does the money go, in procurement?

General CANEDY. The bulk of the money is for the mission package, 3,085 pounds that comprise the automatic [deleted] equipment. That is the lion's share of the money. There is also money in that for the procurement of platform.

Mr. CROMWELL. The airframes?

Colonel HEGERICH. Yes, sir.

Mr. CROMWELL. I would like you to supply a breakout of that funding profile for the record.

Colonel HEGERICH. We will do it, sir.

General CANEDY. None of the smart aircraft programs are cheap.

Mr. CROMWELL. That is an average of [deleted].

Colonel HEGERICH. And that cost, of course, includes the ground processing.

Digitized by Google

[The information follows:]

A breakout of procurement costs for CEFLY Lancer is as follows (dollars in millions):

Airframe	[Deleted.]
Aircraft Modification	[Deleted.]
Subtotal aircraft	[Deleted.]
Mission equipment	[Deleted.]
Mission equipment float	[Deleted.]
Ground support equipment	[Deleted.]
Subtotal mission equipment	[Deleted.]
Technical data	[Deleted.]
Training equipment	[Deleted.]
Initial spare parts	[Deleted.]
Subtotal logistic items	[Deleted.]
Grand total	[Deleted.]

TACELIS

Colonel HEGERICH. The AN/TSQ-112 or TACELIS system is part of a program known as the tactcal communications electronic warfare system, or TACOM EW for short. The other part is TACJAM, [deleted] which I will briefly touch on later.

[Deleted.]

The ANOMILQ-34, or TACJAM. TACJAM [deleted].

As with the other systems that I have discussed, TACELIS is found in the [deleted].

DELETED

DELETED

DELETED

Digitized by Google

As is shown by this schedule, the TACELIS [deleted].

DELETED

As is shown on this resource chart, the R.D.T.E. cost of TACELIS is over [deleted].

Next, sir, I would like to describe the AN–ALQ–151, or Quick Fix system.

SYSTEM SECURITY

Mr. CROMWELL. Let me ask you one question.

You talk about two systems there, with very expensive ground processor stations.

Do they have to radiate the communications?

Colonel HEGERICH. Yes, sir.

Mr. CROMWELL. That would appear to be a tactical problem. You wouldn't want to give away the location of your ground station. It is sure to be a high-value target, isn't it?

General CANEDY. It is a high-value target, as a corps tactical operations center is a high-value target.

Mr. CROMWELL. How do you handle the general problem of giving away your locations of radiating——

General CANEDY. Remote antennas where possible, as much as possible, distances up to [deleted] meters, air defense, obviously, and of course, trying to get at those things, which can get at those emitters before they can get you. It is not a simple problem, just as his is not a simple problem, and hardening down-links will help also.

Mr. CROMWELL. The down-link is not as much of a problem of giving away position, it is the up-link that gives away position.

General CANEDY. That is right.

Mr. CROMWELL. OK.

QUICK FIX

Colonel HEGERICH. The next system is the AN/ALQ–151 or Quick Fix system. This system is mounted in an [deleted].

Digitized by Google

DELETED

DELETED

DELETED

Our current plan calls for the Quick Fix II system to complete [deleted].

The R.D.T. & E. amounts shown on this Vugraph are for [deleted].

DELETED

Digitized by Google

Sir, this concludes my presentation.

Mr. CROMWELL. Thank you. That was a very good presentation. I don't have any more questions. I thought we had a very interesting session this morning, and I am sorry we didn't have more in attendance.

Senator Goldwater has submitted two questions for the record.

[Questions for the record follow:]

Senator GOLDWATER. Explain how the EP–3E BRIGAND and BIG LOOK systems work.

Admiral MANDEVILLE. [Deleted.]

Senator GOLDWATER. Is there any commonality between Rivet and Joint and the EP–3E Elint systems?

ANSWER. From an operational viewpoint, the manual EP–3E Elint system is similar in function and operational capability to the manual portion of the Rivet Joint Elint system. However, the EP–3E does not have a capability equivalent to the automatic system (AEELS) on Rivet Joint. Considering "black box" commonality, the answer is none because the EP–3E Elint system is representative of electronics technology in the late 1960's whereas Rivet Joint manual Elint systems were initially procured in 1974.

Mr. CROMWELL. Thank you very much, gentlemen. The subcommittee will stand in recess until Monday when we will hear the Marine Corps.

[Whereupon, at 12:06 p.m., the subcommittee recessed to reconvene Monday, March 14, 1977.]

Digitized by Google

MILITARY PROCUREMENT, FISCAL YEAR 1978

MONDAY, MARCH 14, 1977

U.S. SENATE,
SUBCOMMITTEE ON TACTICAL AIR
OF THE COMMITTEE ON ARMED SERVICES,
Washington, D.C.

MARINE CORPS AVIATION AND NAVY SHIPBOARD MISSILES

The subcommittee met pursuant to notice at 9:05 a.m. in room 224, Russell Senate Office Building, Senator Barry Goldwater, presiding.

Present: Senator Goldwater.

Also present: Charles H. Cromwell and Robert Q. Old, professional staff members.

Senator GOLDWATER. The meeting will come to order.

Regretfully, the chairman is detained in Nevada because of the illness of his mother.

CHAIRMAN'S OPENING STATEMENT

Today the subcommittee will have a hearing covering two separate subjects. First, we will review the Marine aviation program, including our annual update on the Marine Air Force structure, and specific program reviews on the AV-8B advanced Harrier V/STOL development effort, the AH-1T attack helicopter used by the Marines, and the OV-10D night observation gunship. The Marine Corps' troop lift helicopters are not specifically covered by this subcommittee and will be reviewed in detail by the R. & D. or General Procurement Subcommittees as appropriate.

Following the Marine Corps programs, we will take up the Navy shipboard SAM missiles, including the Aegis system, Standard missiles, Point Defense systems, and Vulcan Phalanx antimissile gun system.

For the first half of our session this morning, the principal witness will be Lt. Gen. Thomas Miller, USMC, Deputy Chief of Staff, Aviation. He is accompanied by Rear Adm. Robert Mandeville, Assistant DCNO (Air), and the program managers for the various specific weapon systems.

83-367 O - 77 - 1

Digitized by Google

General Miller, will you proceed with the briefing?

STATEMENT OF LT. GEN. THOMAS H. MILLER, U.S. MARINE CORPS, DEPUTY CHIEF OF STAFF FOR AVIATION, HEADQUARTERS, U.S. MARINE CORPS, ACCOMPANIED BY REAR ADM. R. C. MANDEVILLE, DIRECTOR, AVIATION PLANS AND REQUIREMENTS DIVISION, DCNO (AIR WARFARE); REAR ADM. E. R. SEYMOUR, U.S. NAVY, DEPUTY COMMANDER, PLANS AND PROGRAMS, NAVAL AIR SYSTEMS COMMAND; CAPT. MIKE G. BASFORD, U.S. NAVY, HEAD, BUDGET AND LEGISLATIVE SECTION, AVIATION PLANS AND REQUIREMENTS DIVISION, DCNO (AIR WARFARE); COL. STANLEY P. LEWIS, U.S. MARINE CORPS, AV-8 WEAPON SYSTEM PROGRAM MANAGER, PMA-257, NAVAL AIR SYSTEMS COMMAND; JAMES P. DARR, DIRECTOR, PROCUREMENT BUDGET DIVISION, NAVAL AIR SYSTEMS COMMAND; COL. JOHN V. COX, U.S. MARINE CORPS, HEAD, PLANS AND READINESS BRANCH, AVIATION DEPARTMENT, HEADQUARTERS, U.S. MARINE CORPS; COL. CLAYTON L. COMFORT, U.S. MARINE CORPS, HEAD, AIR WEAPONS SYSTEMS BRANCH, AVIATION DEPARTMENT, U.S. MARINE CORPS; LT. COL. RICHARD J. MORLEY, U.S. MARINE CORPS, HEAD RECONNAISSANCE SECTION, AIR WEAPONS SYSTEM BRANCH, AVIATION DEPARTMENT, HEADQUARTERS, U.S. MARINE CORPS; MAJ. LAWRENCE E. REED, U.S. MARINE CORPS, HEAD, BUDGET REVIEW SECTION, PLANS AND READINESS BRANCH, AVIATION DEPARTMENT, HEADQUARTERS, U.S. MARINE CORPS

General MILLER. Thank you, Mr. Chairman.

MARINE AVIATION FORCE STRUCTURE REVIEW

I am pleased to have the opportunity to appear before you today, with Rear Admiral Mandeville, who represents Navy aviation, and Rear Admiral Seymour from the Naval Air Systems Command, to brief you on the current posture of Marine aviation and the funding required in fiscal year 1978 to support our forces in the midrange period.

As I indicated, Naval aviation is made up of Navy and Marine Corps components. The procurement, modification and support of the aircraft which make up these Navy and Marine components is the product of a fully integrated system.

For the most part we operate the same kinds of aircraft, with differences occurring only in response to the Navy's peculiar requirements in support of sea-control missions such as antisubmarine war-

Digitized by Google

fare, or Marine Corps' peculiar power projection requirements of amphibious assault with rapid transition to operations from austere sites ashore.

MARINE AIRCRAFT

(FUTURE AIRCRAFT IN PARENTHESIS)

TACAIR	
FIGHTER/ATTACK	F-4, (F-18)
ATTACK	A-6, A-4, AV-8, (AV-8B)
RECONNAISSANCE	RF-4
ELECTRONIC WARFARE	EA-6
AERIAL REFUELERS	KC-130
LAND FORCES	
OBSERVATION	OV-10
COMMAND AND CONTROL	UH-1
ASSAULT TRANSPORT	CH-46, CH-53 (CH-53E)
ASSAULT ESCORT	AH-1
BASE SUPPORT	
SAR	HH-46, UH-1
DIRECT SUPPORT AIRLIFT	C-9, CT-39
UTILITY/ADMIN TRANSPORT	U-11, US-2, C-117, C-118 (CTX)

In addition to being combat ready, Marine aviation units are deployed around the globe on ships at overseas bases. They are a mobile force available to provide almost immediate response throughout the world in peacekeeping deterrence, rescue or presence, all in support of national interests.

Even though we Marines have been ordered ashore on only a relatively few occasions, as attested by a recent Brookings Institute study, the Nation has called on its naval forces in support of its diplomatic objectives more than 179 times since World War II.

Recently, the amphibious forces of the Department of the Navy have been called upon on three important occasions to support diplomatic objectives. These were the Saigon evacuation, the Phnom Penh evacuation, and the *Mayaguez* operation. Perhaps if we can sustain this type of responsive capability the need to be ordered ashore in an assault configuration will not reoccur.

The importance of these naval forces, including Navy and Marine aviation, is obviously not lost in the Congress. You have consistently supported us over the years and retained—under title X of the United States Code—approved authority over changes in the functions or capabilities of the services.

Digitized by Google

MARINE AIRCRAFT WINGS

WING	HQ LOCATION
1ST MAW	CAMP ZUKERAN, JAPAN
2D MAW	CHERRY POINT, NC
3RD MAW	EL TORO, CA
4TH MAW (RESERVE)	NEW ORLEANS, LA

The Marine Corps is organized into four division-wing teams, three active and one reserve. These air-ground teams are employed as fully integrated amphibious forces, approximately sized and task organized to perform assigned missions.

MARINE CORPS
TASK ORGANIZED AIR-GROUND TEAMS

MARINE AMPHIBIOUS FORCE (MAF)

MARINE AMPHIBIOUS BRIGADE (MAB)

MARINE AMPHIBIOUS UNIT (MAU)

In size, such task organized forces vary from the Marine amphibious force, MAF, which can include a Marine division plus an air wing of approximately 400 fixed-wing aircraft and helicopters, down to the Marine amphibious unit, MAU, which normally consists of a battalion landing team, BLT, and a composite squadron of various types of helicopters. When appropriate, the MAU composite squadron may also include AV-8 V/STOL aircraft and observation aircraft.

Marine aviation is structured to provide the aviation combat supporting arm for these amphibious forces in any or all of five functional

Digitized by Google

MARINE AVIATION FUNCTIONAL AREAS

FUNCTION	WEAPONS SYSTEMS
ANTI-AIR WARFARE	FIGHTER AIRCRAFT/SAMS
OFFENSIVE AIR SUPPORT	ATTACK AIRCRAFT
RECONNAISSANCE	MULTISENSOR RECCE AIRCRAFT/ ELECTRONIC WARFARE AIRCRAFT
ASSAULT SUPPORT	TRANSPORT, COMMAND AND CONTROL AND ATTACK HELOS/AERIAL REFUELERS
COMMAND AND CONTROL	RADAR DETECTION AND AIRCRAFT COMMAND AND CONTROL SYSTEMS

areas: antiair warfare, offensive air support, tactical reconnaissance including electronic warfare, assault support, and control of aircraft and missiles.

RPV'S FOR MARINES

Senator GOLDWATER. Are you using RPV's yet for reconnaissance?

General MILLER. No, sir; we are not.

Senator GOLDWATER. Are you experimenting with it?

General MILLER. We are following both U.S. Air Force and U.S. Army programs very closely in this area. We have on occasions tested RPV's, the smaller units, generally used for reconnaissance by ground units, but we don't have any at the present time.

Senator GOLDWATER. All right.

REQUIRED FUNCTIONS

General MILLER. This broad spectrum of required aviation functions results in Marine aviation being the Nation's only tactical aviation asset trained and equipped to operate equally well from either sea bases or austere expeditionary bases ashore. This versatility in employment capability enables Marine aviation, although relatively small, to stand ready to respond whenever and wherever needed with a total force capable of meeting the majority of enemy threats.

We are proud of this closely integrated team. The marine crossing the beach or climbing the hill can be confident of being supported in combat by marines with whom he has trained and who understand and share his personal concern for reaching his assigned objectives in as healthy a condition as possible.

To provide this aviation combat supporting arm for the amphibious force commander, the Marine Corps operates approximately 30 percent of the Department of the Navy's active inventory of aircraft.

Marine aviation, as an intergral part of Naval aviation, is not unlike the aviation forces of the other services, in that it must undergo continuous evolution to maintain the appropriate capabilities, mix, and size of its forces.

Digitized by Google

DEPARTMENT OF THE NAVY AIRCRAFT PROCUREMENT

FY-78 (BA 1-4)

TOTAL (#/$M)	169/1950
USMC	19/183

In fiscal year 1978 the Marine Corps is concentrating on aircraft update and modification programs to improve the readiness and capabilities of our present aircraft, rather than modernizing through procurement; hence only 19 of the Department of the Navy's procurement requests of 169 aircraft are programed as Marine Corps assets.

DON AIRCRAFT MODIFICATIONS

FY-78 (BA-5)

MODIFICATION FUNDING

TOTAL ($M)	853
USMC	323

In contrast, Marine Corps aircraft account for $323 million of the Department of the Navy's $853 million programed for modification/conversion in lieu of procurement and service-life extension on existing aircraft.

The above circumstance will reverse in the early 1980's with the introduction of the AV-8B, the F-18, and the CH-53E.

MARINE AVIATION FUNCTIONS AND AIRCRAFT

(FUTURE AIRCRAFT IN PARENTHESIS)

FUNCTION	AIRCRAFT
ANTI-AIR WARFARE	F-4 (F-18)
OFFENSIVE AIR SUPPORT	A-6, A-4, AV-8 (AV-8B)
RECONNAISSANCE	RF-4, EA-6, OV-10
ASSAULT SUPPORT	KC-130, AH-1, UH-1, CH-46, CH-53, (CH-53E)
COMMAND AND CONTROL	

Digitized by Google

Our planned fiscal year 1978 expenditures are balanced among the five functional areas of aviation.

I will give an overview of our fiscal year 1978 efforts in each of these functional areas. Following this overview, the Naval Air Systems Command program manager for the AV–8 will brief you in more detail on this aircraft.

As stated previously, the five functional areas of Marine aviation are antiair warfare, offensive air support, tactical reconnaissance, assault support, and command and control.

Marine Corps antiair warfare weapons include Hawk and Redeye, which we expect to replace with the improved Stinger missile, plus fighter/attack aircraft.

Our missile programs are topics of separate briefings and will not be covered today.

F-4J TO F-4S CONVERSION IN LIEU OF PROCUREMENT

PROGRAM FEATURES

9 YEAR (+) SERVICE LIFE EXTENSION

SMOKELESS ENGINES

MANEUVERING SLATS

*AWG 10A RADAR

*REWIRING

*MODIFICATIONS DEVOTED TO INCREASED RELIABILITY AND MAINTAINABILITY

Our present fighter/attack aircraft is the F–4 Phantom. The Phantoms have been in our inventory since the early 1960's and will not be completely replaced by a follow-on fighter until 1989. To extend the service lives and usefulness of these aging aircraft into the 1980's we plan to conduct a conversion in lieu of procurement rework on our F–4J's. This program will include an improved and more reliable radar, rewiring, smokeless engines, and maneuvering slats.

The F–18 on which you will be separately briefed is programed to enter service with the Marine Corps and commence replacing the F–4 in fiscal year 1982. The introduction rate is planned at two squadrons per year, with the F–4 completely retired from our Active and Reserve Forces by 1989.

Digitized by Google

FY78 DON ANTI-AIR WARFARE AIRCRAFT PROGRAMS WITH DIRECT MARINE CORPS INTEREST

ADVANCE PROCUREMENT ($M)

F-18	29

MODIFICATIONS ($M)

F-4J TO F-4S CILOP	79

Our offensive air support, or attack forces consist of A–6, A–4, and AV–8A aircraft.

FY78 OFFENSIVE AIR SUPPORT AIRCRAFT PROGRAMS WITH DIRECT MARINE CORPS INTEREST

PROCUREMENT (#/$M)

A-6E	12/178

MODIFICATIONS ($M)

A-6 CILOP	92
A-6E TRAM	32
*A-4M (ARBS)	10
*AV-8A TO AV-8C CILOP	16
*TAV-8A (EJECTION SEAT)	2

*MARINE CORPS ONLY

The A–6 provides us with a unique and vital capability for around-the-clock, all-weather attack and close-air-support capability. Our fiscal year request includes only procurement necessary to maintain currently approved force levels of this essential aircraft through the 1980's, and includes modification funding to update existing assets with

Digitized by Google

the target recognition and attack multisensors, TRAM. The TRAM-modified A–6's will be equipped with a laser ranging and designating system plus an infrared detecting system to detect and attack targets at night. This all-weather A–6 attack force is complemented by less expensive and simpler A–4 and AV–8A light attack aircraft.

We plan to eventually replace the venerable A–4 with the AV–8B, but the A–4 will remain in our Active Force inventory through fiscal year 1986, and will be in our Reserve Forces through 1990; hence we plan to increase the first pass ordnance delivery accuracy of the A–4M with the addition of a [deleted] accuracy angle rate bombing system, ARBS.

Since Col. Stan Lewis is going to brief our V/STOL AV–8 programs, I won't say much about these aircraft other than to reaffirm our confidence in the inherent operational flexibility and responsiveness of V/STOL.

Our follow-on V/STOL light attack aircraft, the AV–8B, will have among other advantages, greater range and payload than either the A–4M or the AV–8A. The AV–8B will have the range to rapidly deploy long distances without inflight refueling; for example, it will be able to fly from the west coast of the United States to Hawaii without airborne tanker support.

In today's and tomorrow's electronically sophisticated and rapidly moving military conflict, the importance of up-to-date intelligence and electronic countermeasures cannot be overemphasized.

FY78

DON RECONNAISSANCE AIRCRAFT PROGRAMS WITH DIRECT MARINE CORPS INTEREST

PROCUREMENT (#/$M)	
EA-6B	6/138
MODIFICATIONS ($M)	
* RF-4B CILOP	33
* OV-10A TO OV-10D CILOP	21

*MARINE CORPS ONLY

Our fiscal year 1978 request includes funding to update the Marine Corps' tactical reconnaissance aircraft, the RF–4B, to improve the all-weather data gathering capabilities of these aircraft and to make their sensor systems common with the USAF RF–4C.

Digitized by Google

Also included in the request are funds to continue ongoing replacement of the aging EA-6A electronic warfare aircraft with the more capable EA-6B.

Included in this functional area are our OV-10 observation aircraft. The marine aviation fiscal year 1978 requests contains the final increment of funding to complete a modification providing a laser target designating system and night observation capability for 18 of these aircraft.

FY78 DON ASSAULT SUPPORT AIRCRAFT PROGRAMS
OF DIRECT MARINE CORPS INTEREST

PROCUREMENT (#/$M)	
AH-1T	8/29
MODIFICATIONS ($M)	
CH-53 (EXT TANKS, ROTORHEAD, BIM, ETC.)	14
CH-46 (CILOP, ROTOR BLADES)	105
KC-130F TO KC-130R CILOP	16
AH-1 (INFRARED SUPPRESSION)	3

Marine Corps' assault support aircraft include aerial refuelers, attack helicopters and assault lift helicopters. Some of our KC-130F aerial refuelers are nearing the end of their service lives, and our fiscal year 1978 request includes funding to extend the airframe lives of these aircraft until a suitable modern replacement can be obtained in the mid-1980's.

MARINE AERIAL REFUELING

Senator GOLDWATER. Is there any reason that the marines did not use the KC-135 for refuelers?

General MILLER. The primary concern, sir, is the aircraft size. The runway requirements would be difficult to support in an expeditionary environment, so consequently we have remained with the KC-130 until we can find a replacement that can operate more efficiently off expeditionary airfields.

Senator GOLDWATER. Do you use the drogue?

General MILLER. Yes, sir, we use the drogue, the same system as Navy aviation; however, we have operated on some occasions more from a training aspect with the KC-135 with marginal results where the Air Force attached a drogue to the boom for use——

Senator GOLDWATER. I see.

Digitized by Google

HELICOPTER

General MILLER. Our attack helicopter force provides the assault lift helicopters with armed escort for close in fire suppression during a heliborne assault.

The eight AH-1T aircraft we plan to procure will be equipped to carry TOW antitank missiles.

The other funding requested for AH-1 attack helos is to provide modifications to improve their survivability and their night operating capabilities.

Funding is requested for the modification of the Marine Corps' CH-46 and the CH-53 assault lift helicopters; however, I want to point out that the Marine Corps is not asking for any new procurement in transport helicopters but only the necessary funds to improve what we already have.

The fifth functional area of Marine aviation, command and control of aircraft and missiles, is funded separately through Marine Corps' procurement and O. & M. budgeting and will be briefed to the committee by the Marine Corps' Deputy Chief of Staff for Installations and Logistics, Maj. Gen. Jim Jones.

A portion of the base and command support aircraft procurement requested by the Department of the Navy is to meet Marine Corps requirements. The CTX aircraft requested are urgently required to replace old reciprocating engine aircraft such as the US-2, U-11, and C-117.

That is the extent ofthe Marine aviation procurement and modification budget requests for fiscal year 1978.

As you know, Marine aviation is supported by Department of the Navy dollars, spares, depot repair facilities, and aviation training funds; therefore, these vital portions of the budget are as important to us as they are to the Navy side of Naval aviation.

I strongly support the Department of the Navy's appropriation request since it is an overall,integrated, and mutually supporting Naval aviation program carefully structured within funding guidelines with a minimum of risk.

Gentlemen, that concludes my briefing.

If there are no questions, Colonel Lewis will now cover our AV-8 programs.

Senator GOLDWATER. We will go ahead with the AV-8, and then we have some questions on the whole presentation.

General MILLER. Yes, sir.

Senator GOLDWATER. Thank you very much. I have to leave for a short time and Mr. Cromwell and Mr. Old will continue.

General MILLER. Colonel Lewis.

Mr. CROMWELL. Let's hold up until Senator Goldwater gets back. I will ask some questions which otherwise would just have to go into the record.

MARINE CORPS SHARE OF NAVAL AVIATION

General Miller, your statement that Marine aviation will get only 19 of 169 new aircraft requested in the fiscal year 1978 budget, that is a rather startling figure.

Digitized by Google

What are the 19 aircraft?

General MILLER. The 19 aircraft are four A–6's, three EA–6B's, eight AH–IT's, and four CTX's.

Mr. CROMWELL. Now, we ask you every year what percent of the total Department of the Navy aviation budget is going to the Marine Corps. What is the figure for fiscal year 1978?

General MILLER. It is 11 percent of the aircraft but 19 percent of the APN funding.

MARINE AIR FORCE STRUCTURE PLAN

Mr. CROMWELL. In examining your fiscal year 1978 force structure, would you give us a breakdown of this year's TAC air and land forces structure by aircraft type and by squadrons?

Do you have that, or do you want to put that in the record?

General MILLER. Let me provide that for the record, to save you time. We can give you the totals, if you would prefer at this time, then break that down.

For instance, we have [deleted] tactical aircraft [deleted] and [deleted] tactical training aircraft.

We have in the land forces aviation [deleted] aircraft, [deleted] with an additional [deleted] training aircraft. We also have [deleted] base and command support aircraft, for a total of [deleted] aircraft.

Mr. CROMWELL. Would you then amplify that for the record? Give us the 5-year force structure plan for TacAir and land forces, and show it by aircraft type and by squadron.

General MILLER. I believe I can give you that information with the following viewgraph.

5-YR DEFENSE PLAN FOR TACAIR AND LAND FORCES

Aircraft	Sq.	UE	Present	1978	1979	1980	1981	1982
Tacair:								
F-4/F-18	12	12	144	144	[Deleted.]			
A-6	5	12	60	60				
A-4	5	16	80	80				
AV-8	3	20	60	60				
RF-4	1	21	21	21				
EA-6	1	15	15	15				
KC-130	3	12	36	36				
TA-4	[1] 10		30	30				
C-117			20					
Total			466	466	=[Deleted.]			
Land forces:								
CH-46	9	18	162	162	[Deelted.]			
AH-1	3	18	54	72				
UH-1	4	21	84	72				
OV-10	2	18	36	36				
CH-53	6	21	126	126				
Total			462	468	=[Deleted.]			

[1] Aircraft per wing.

This is the present 5-year defense plan in Tacair. F–4's [deleted] squadrons of [deleted] aircraft each; A–6's [deleted] squadrons of [deleted] each; A–4's [deleted] squadrons of [deleted] each; and AV–8's squadrons of [deleted] each; RF–4's is [deleted] each; and EA–6's [deleted] squadron of [deleted] each;KC–130 squadrons of

Digitized by Google

[deleted] each; [deleted] andwe have [deleted] TA–4 aircraft as TacticalAir Coordinators Airborne (TACA) aircraft.

Mr. CROMWELL. Those are FAC's?

General MILLER. TACA, not FAC.

The OV–10 aircraft normally operate as the forward air controller (FAC) airborne.

Mr. CROMWELL. This year's 5-year force structure is unchanged as presently planned. It is constant through the 5-year period?

General MILLER. That is correct.

Mr. Cromwell, the Tac Air budget of the Ford administration and the Carter administration was not changed.

Mr. CROMWELL. And it was unchanged by the Carter PBD decisions?

General MILLER. That is correct. The only change that we are aware of at the present time was a delay of 1 year with the CH–53E heavy lift helicopter.

EXTENDED LONG-RANGE PLAN

Mr. CROMWELL. Then if you took your 5-year plan and you extended it out to 1990, under the present Extended Planning Annex, what aircraft will change in the force and which ones will you still be operating by 1990?

General MILLER. We would expect some change in the light attack force, AV–8B will replace the A–4M and AV–8A.

I believe that this will be the only Tac Air change. The other changes that would occur are presently programed in helicopter forces.

Mr. CROMWELL. All right. Thank you very much.

Do you want to continue now with the AV–8B?

Senator GOLDWATER. Do you plan to cover the F–18 at all?

General MILLER. Mr. Chairman, that will be covered tomorrow in depth, since it is both a Navy and a Marine Corps program.

Senator GOLDWATER. Have they cut any "tin" yet?

General MILLER. I will ask Admiral Mandeville.

Admiral MANDEVILLE. Not really, not as far as putting an airplane together, no, sir.

Senator GOLDWATER. Is the engine completely tested?

Admiral MANDEVILLE. The engine has come on very well.

Admiral SEYMOUR. The engines have been fabricated, two prototypes, and they do have them in test now. They have not started the production engines, but they do have an engine in test at Trenton, and it is doing very well.

Senator GOLDWATER. We will wait until tomorrow.

Admiral SEYMOUR. Yes, sir.

AV–8B PROGRAM REVIEW

Colonel Lewis. The AV–8B is an advanced vectored thrust V/STOL aircraft planned for production in the 1980s.

We will present information on the subjects shown here on the outline slide.

The first subject is the inventory requirement.

At present the Marine Corps' light attack aircraft force consists of A–4 andAV–8A aircraft. We are projecting an inventory short-

Digitized by Google

fall in the 1982–83 time period of up to 18 aircraft, even though we plan to extend the service life of our existing planes.

The AV–8B is intended to replace the A–4 and the AV–8A and will be the primary light attack aircraft for the Marines in the 1980's and 1990's.

We have structured the AV–8B program such that it will be ready for production in 1981 to meet the projected inventory shortfall.

The AV–8B is an improved version of the AV–8A aircraft, incorporating the latest American technology into the original British design of the AV–8A.

We have redesigned the inlet to provide better propulsion efficiency. We have also redesigned the wing to incorporate NASA supercritical airfoil technology and an advanced wing-flap design. The wing will be constructed with the most advanced materials' technology in the world, making extensive use of graphite epoxy composite material and saving 330 pounds of weight, compared to a metal wing design.

We are also installing VTO lift improvement devices on the bottom of the airplane to capture reflected high energy air from the vectored nozzles of the engine and to boost the aircraft out of negative ground effect.

IMPACT OF GROUND EFFECT

Senator GOLDWATER. What is the effect of that ground effect on this airplane?

Colonel LEWIS. It is negative in the AV–8A. We actually have a suck down under the fuselage because of the geometry of the four nozzles, and also there is a push down on top of the wing from the air circulation.

These lift improvement devices form sort of a little box under the airplane. There is a dam that retracts, and strakes on the gun pods, or without the gun pods, longer strakes. The dam, which retracts with the nose gear mechanism, forms a box and actually gives a positive effect and eliminates 1200 pounds of problems down that way with the added effect of the new inlet, total vertical lift is increased by at least 1800 pounds.

Senator GOLDWATER. How high is the air effect, how many feet?

Colonel LEWIS. It goes up to probably 20 feet, and after that——

Senator GOLDWATER. Twenty feet?

Colonel LEWIS. Yes; at 20 feet you start feeling it. Below 20 feet you start getting into a cobblestone effect, and the turbulance increases as you go on down.

We expect that those devices will probably be relatively ineffective beyond 20 feet. Once you break that ground effect and get up and out, then you get an additional reduction of recirculation in the engine of hot air.

Senator GOLDWATER. As you transition into horizontal flight, do they retract?

Colonel LEWIS. Yes, sir. The dams retract with the landing gear and the nose gear.

Senator GOLDWATER. Thank you, sir.

Digitized by Google

DESIGN IMPROVEMENTS

Colonel LEWIS. With these aircraft design improvements, the AV-8B will have the approximately 100-percent increase in payload or in combat radius compared to the AV-8A. The AV-8B will be powered by the same engine as we are now using in the AV-8A.

We have tested the improved design features of the AV-8B with the full-scale hardware using a Pegasus-11 engine in a modified AV-8A.

Shown here is the AV-8B model on the stratic test facility at NASA, Ames, where it was calibrated for VTO performance prior to installation in the NASA, Ames' 40-foot by 80-foot wind tunnel.

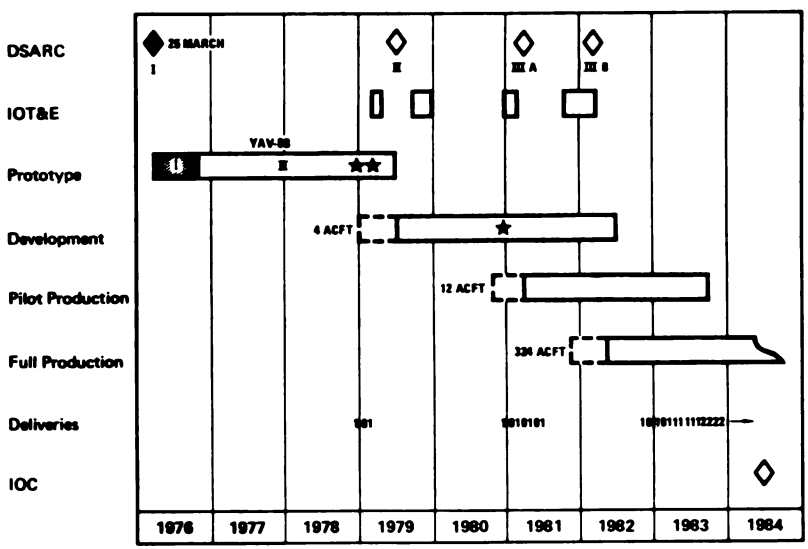
The NASA, Ames tests were completed in September 1976, using the NASA data. We now have a high degree of confidence in the predicted aircraft performance shown here.

The cross-hatched area shown represents the range of data we had on earlier 15 percent scale-model testing, which was strongly influenced by the exact design of the front nozzles of the Pegasus engine.

We have now confirmed the nozzle design in the full-scale tests at NASA, and we achieved slightly better results than were obtained in the small-scale testing.

This chart represents an overview of the various phases of the AV-8B program.

AV-8B PROGRAM



LLA

Digitized by Google

We are presently in the prototype phase, in which we will build and test two YAV–8B aircraft to accurately assess the performance and flying qualities of the production AV–8B aircraft.

The next phase is full-scale development which starts in 1979, when we will incorporate the avionics, armament and other subsystems intended for the production of AV–8B aircraft.

The AV–8B program has had some significant changes since the fiscal year 1977 briefings to Congress which resulted from the DSARC review and guidance.

AV-8B PROGRAM CHANGES

- RESTRUCTURE PRODUCTION SCHEDULE
- ADD TWO ADDITIONAL R&D AIRCRAFT
- INCREASE R&M ACTIVITY
- EVALUATE RAISED COCKPIT CONFIGURATION AND IMPROVED WEAPONRY
- R&D COST INCREASE $122M

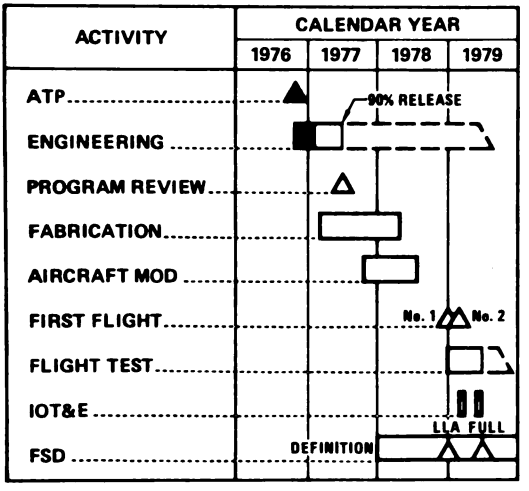
We have dropped the requirement for production funds in fiscal year 1980 and added two more R. & D. aircraft.

We are also conducting extensive subsystem design analysis to improve reliability and maintainability and to reduce operating and support cost.

The net effect of these changes has increased the R. & D. cost and reduced the APN cost over the fiscal year demonstration program years.

Digitized by Google

FLIGHT DEMONSTRATION PROGRAM



ACCOMPLISHES

- PRODUCTION INLET
- PRODUCTION WING
- PRODUCTION LID's
- PRODUCTION PYLONS
- 120 HOUR FLIGHT TEST
- 100% FLIGHT ENVELOPE
- 80% V_N TESTED
- MISSION CAPABILITY VERIFIED
- PRODUCTION BASE ESTABLISHED
- FSD CONTRACT DEFINITION

The request for fiscal year 1978 funds in the amount of $60.3 million will continue the YAV–8B flight demonstration program which commenced in fiscal year 1977. The two YAV–8B aircraft are engineering prototypes which have a high degree of production relevance in the manufacture of the new design features of the AV–8B.

FY 1978 ACTIVITY

- YAV-8B AIRCRAFT MODIFICATION COMPLETED
- YAV-8B ENGINE MODIFICATION COMPLETED
- COMPOSITE WING STRUCTURAL TEST COMPLETED
- AVIONICS EQUIPMENT SELECTED
- AVIONICS TEST PROGRAM INITIATED
- FULL SCALE DEVELOPMENT DEFINED

88-379 O - 77 - 14

Digitized by Google

The fiscal year 1978 funds will complete construction of the two flight-test articles and begin the long lead design and test activity of the avionics system which will be installed in full scale development aircraft.

The AV-8B funding profile is shown here, including both R. & D. and projected APN dollars over the fiscal year demonstration program years.

The numbers in red were briefed last year. The black numbers show the current program with the DSARC adjustments.

AV-8B FUNDING

DOLLARS IN MILLIONS

	FISCAL YEAR						
	PRIOR	1977	1978	1979	1980	1981	1982
RDT&E	6.3	33.0	60.3	167.0	129.8	91.0	75.3
PROCUREMENT						260.9	307.9
UNITS						12	24

Colonel LEWIS. Are there any questions, sir?

BRITISH SEA HARRIER

Senator GOLDWATER. I noticed in a magazine last night that England is making an AV-8 exclusively for seaborne use.

Are we going to get into that, or is there any need for it?

Colonel LEWIS. The Sea Harrier program is a unilateral program, a derivative program from the AV-8 program. They are building 2 dozen of them for the Royal Navy.

Our own Navy has not expressed an interest in the British aircraft. There has been a dialog between the Chief of Naval Operations and the Commander Naval Air Systems Command on naval applications of the AV-8B aircraft, and that dialog, I am sure, will continue, sir.

Senator GOLDWATER. Why would there be a need for a change in it? Wouldn't the land-based operate off of the carrier just as well as off the land?

Colonel LEWIS. Yes, sir. The changes would not be in the basic aerodynamics or engine or construction of the aircraft; the changes, if any, would be in the weapon system.

Digitized by Google

Colonel LEWIS. Night close air support with the AV–8A is the same with an A–4 or any other aircraft not equipped with radar. Our A–6's have our primary close air support role at night with offset bombing, beacon bombing, like we did in Vietnam.

The AV–8's rely on the TPQ ground-control radar which is quite accurate. The new systems are quite reliable. Of course, there is the old work under the flares—visual bombing, lighting up the target and dropping that way at night.

In addition, other weapon systems coming along will enable us to give much better close air support at night. This capability isn't inherent in the aircraft but certainly the laser designation of targets with dropping laser guided bombs at night is something you can do from any kind of aircraft.

AV–8B BOMBING SYSTEM

Senator GOLDWATER. Would the AV–8B be able to carry the fire control system of the A–6?

Colonel LEWIS. Of the A–6?

Senator GOLDWATER. Yes.

Colonel LEWIS. Not that fire control system as such.

The AV–8B is a smaller aircraft. If you were able to build a fire control system, a radar with appropriate qualities and a computer and fire control system, utilizing large-scale integrated circuitry, there is no reason it couldn't be done. You could build in the computation system and radar, you could do that.

There is no reason in the world it couldn't be done, but it hasn't been done, and it would be expensive.

ECM EQUIPMENT

Senator GOLDWATER. There are, as I understand it, contingency plans that could see the Marine Corps fighting in NATO. Do you believe your aircraft have the proper electronic devices and other capabilities to enable them to operate in that high-threat environment?

Colonel LEWIS. We plan on having such devices on these aircraft, both for radar detection to warn the pilot that he is being illuminated and also to jam.

We currently have a program which is before the Congress now to install some of these devices on AV–8A aircraft, including flare and chaff dispenser and jammer and radar warning.

As you well know, sir, that is a very fluid environment. What we see in Europe right now is not what we will see 10 years from now. The Chief of Naval Operations is going to have to watch very closely to make sure we do equip the aircraft to operate in that environment if that is where the President wants us to operate.

HARRIER AND A–6 CLOSE SUPPORT

Senator GOLDWATER. Basically, then, you look on the Harrier as a day ground-support aircraft; you look on the A–6F as your all-weather day-and-night close-support aircraft?

Digitized by Google

How would these aircraft fit into the Marines' force structure plans?

General MILLER. We are currently looking at the so-called type A V/STOL which is a subsonic aircraft to replace our assault helicopter. CH–46, and that is the reason that we are continuing with the CH–46 and 53 update programs to stretch their force structure to that time frame.

The type B or supersonic fighter, we envision at this time, as a possible later replacement for the F–18 in an attempt to go all V/STOL.

SURVIVABILITY IN CLOSE AIR SUPPORT

Senator GOLDWATER. The AV–8 and the A–10 are designed to fly close air support. What kind of armament protection will AV–8B carry similar to the A–10?

Colonel LEWIS. We are not going to armor the aircraft, sir. As you know, the A–10 does have armor around the cockpit area, titanium armor, to protect the pilot and the avionics in the cockpit. That is the main armor in the aircraft.

Weight in a V/STOL aircraft is of such primary importance we don't feel we can afford to do that; however, our approach at survivability over the battlefield is, first of all, it is very hard to acquire very small aircraft; the AV–8B is very nimble and very fast and hard to hit.

With the small smokeless engine, the extreme acceleration characteristics of the aircraft, its small size and its agility, we feel it will survive not by taking hits, but by not getting hit.

Senator GOLDWATER. That is the constant prayer.

General MILLER. I might add, Mr. Chairman, that our experience with the A–4 in Vietnam has done much to make us confident of this position. That is one of the reasons we prefer the smaller, more agile aircraft.

Senator GOLDWATER. I have wondered if that was not one of the major reasons that you like the A–4 so much, the Israelis like it, and the Navy likes it—because of its size; is that true?

General MILLER. Yes, sir, I think it is a reasonably simple airplane to maintain. It is reliable; it is effective as a close air support airplane, I think, primarily because of its size and speed; and it has proved successful as a light attack airplane.

Colonel LEWIS. If I could add one more thing about the survivability of the aircraft, that is one of the big pluses we see with our new wing; it is an all composite design; it has eight wing spars rather than the normal two you might find. Each one of them has low stress loadings on it, and we figure in that critical portion of the aircraft we will be able to survive a bit of battle damage and bring the airplane home.

Senator GOLDWATER. That is on the A–4?

Colonel LEWIS. On the AV–8B.

Senator GOLDWATER. What "G"?

Colonel LEWIS. Seven "G's" full combat envelope.

NIGHT CLOSE AIR SUPPORT

Senator GOLDWATER. What is the Marine Corp's concept of operations for night close air support for the AV–8A?

Digitized by Google

Colonel LEWIS. Night close air support with the AV–8A is the same with an A–4 or any other aircraft not equipped with radar. Our A–6's have our primary close air support role at night with offset bombing, beacon bombing, like we did in Vietnam.

The AV–8's rely on the TPQ ground-control radar which is quite accurate. The new systems are quite reliable. Of course, there is the old work under the flares—visual bombing, lighting up the target and dropping that way at night.

In addition, other weapon systems coming along will enable us to give much better close air support at night. This capability isn't inherent in the aircraft but certainly the laser designation of targets with dropping laser guided bombs at night is something you can do from any kind of aircraft.

AV–8B BOMBING SYSTEM

Senator GOLDWATER. Would the AV–8B be able to carry the fire control system of the A–6?

Colonel LEWIS. Of the A–6?

Senator GOLDWATER. Yes.

Colonel LEWIS. Not that fire control system as such.

The AV–8B is a smaller aircraft. If you were able to build a fire control system, a radar with appropriate qualities and a computer and fire control system, utilizing large-scale integrated circuitry, there is no reason it couldn't be done. You could build in the computation system and radar, you could do that.

There is no reason in the world it couldn't be done, but it hasn't been done, and it would be expensive.

ECM EQUIPMENT

Senator GOLDWATER. There are, as I understand it, contingency plans that could see the Marine Corps fighting in NATO. Do you believe your aircraft have the proper electronic devices and other capabilities to enable them to operate in that high-threat environment?

Colonel LEWIS. We plan on having such devices on these aircraft, both for radar detection to warn the pilot that he is being illuminated and also to jam.

We currently have a program which is before the Congress now to install some of these devices on AV–8A aircraft, including flare and chaff dispenser and jammer and radar warning.

As you well know, sir, that is a very fluid environment. What we see in Europe right now is not what we will see 10 years from now. The Chief of Naval Operations is going to have to watch very closely to make sure we do equip the aircraft to operate in that environment if that is where the President wants us to operate.

HARRIER AND A–6 CLOSE SUPPORT

Senator GOLDWATER. Basically, then, you look on the Harrier as a day ground-support aircraft; you look on the A–6F as your all-weather day-and-night close-support aircraft?

Digitized by Google

Colonel LEWIS. Yes sir, an Echo, that is our——

General MILLER. We would use the light attack or AV–8B for night visual work as well as day; however, the A–6E is primarily night, poor visibility, bad weather, full spectrum close air support.

Colonel LEWIS. There is a place for light attack. We do stress a lot of night work. Unfortunately—I commanded both A–6 and Harrier squadrons—if you are going to have to go out and do it under very adverse conditions, the only way to do it is with the A–6, except on a clear night, or with a little room for work under overcast. Then it can be done and will continue to be done with whatever is available.

Senator GOLDWATER. General, this is kind of a long question.

MARINE AIR FORCE STRUCTURING

Last year, this subcommittee received extensive testimony on the process by which force structure requirements are developed and force levels are sized. This testimony was presented in our hearing entitled "Four Tactical Air Forces," where the subcommittee examined the factors involved with having all four Services operate their own aircraft.

The Marines showed in detail how their aviation force balance is arrived at, based on threat analysis and also mission sortie requirements. Nevertheless, since one of the first Carter budget amendment proposals was to reduce the Marine's fighter force from 12 down to 9 squadrons, would you give us a brief summary of how you do your force structuring in the Marines and how the Marines trade off forces between ground and air?

General MILLER. Mr. Chairman, the sole purpose of Marine aviation is, of course, to support that young Marine PFC on the ground. Obviously, some of the subfunctions of Marine aviation contribute more directly to this purpose than do others.

While the emphasis may vary, it is important to remember that all of the functions contribute and must be performed; but as our aviation requirements and force structure attest, the emphasis is on those areas that support that Marine on the ground.

The numbers of aircraft, as well as the organization, the tactics and other equipment required to effectively perform these functions are determined by studies and analyses.

These studies, which are only a part of a total Marine Corps 5-year studies program, examine Marine forces in the context of the current strategy and threat for the purpose of deriving numbers of sorties, the expeditionary airfield requirements, portable fueling systems, air defense radars and other systems which require them to support the landing force.

The Marine Corps has a formal systematic process for developing its aviation requirements because we recognize that the process is still more art than science.

The Marine Corps is consistently striving to improve. For example, we have just completed about $1½ million multiyear effort called the Marine aviation requirement study. While not yet fully implemented,

Digitized by Google

this study produced four computer models designed to aid in the process of requirement determination.

The requirements generated by this studies program are incorporated in the Marine Corps midrange objective plan or MROP—if I could have that Vugraph.

TACAIR

AIRCRAFT	MROP	JSOP	FYDP
F-4			
A-6			
LIGHT ATTACK A-4 AV-8			
RF-4			
EA-6			
KC-130			
TA-4			

DELETED

You will note that the first column is the Marine Corps midrange objective plan, MROP, and the figures on the left address the requirements for one Marine division, Marine amphibious force equipment.

This provides the basis for submission of our requirements into the joint strategic objectives plan, or JSOP, and that is reflected in the middle column.

This reflects a requirement that Services mutually agree to be reasonably obtainable and within the bounds of prudent risk. Then after being further scrubbed to conform with the Secretary of Defense guidance, the constrained requirements appear in the Department of the Navy POM, and finally in the 5-year defense plan as displayed in the far right column.

TO ESTABLISH TACAIR AIRCRAFT REQUIRED FOR MMROP

SORTIES REQUIRED (FROM STUDIES OR JUDGEMENT) = AIRCRAFT REQUIRED
SORTIE RATE (FROM OPERATIONAL DATA)

Now the sortie requirement determined for a division and wing is estimated for high intensity combat. The sorties required is divided by the sortie rate to obtain the number of aircraft required.

The MROP figures are based on the planned sustained sortie rate for each category of aircraft for all three of the Marine amphibious forces.

Digitized by Google

Again, the figures reflect the requirement imposed by high intensity combat. These figures reflect the requirements imposed by high intensity combat.

The JSOB figures reflect the JCS-approved objective force for fiscal year 1978 that is considered physically obtainable and yet within the bounds of prudent risk.

As I indicated, the 5-year defense plan, FYDP, is the programs levels allowed by fiscal constraints. This is the so-called sustained rate and surge rate of our aircraft types from which we determine the sorties required and then the ability of that aircraft to perform those sorties.

I have, as one example, for the attack aircraft requirements one Marine amphibious force and how the sorties are broken down by mission and requirements.

Senator GOLDWATER. Have you been given enough firm information by the Secretary of Defense to enable you to determine your force structure in 5 years?

General MILLER. Our force structure, Mr. Chairman, of course, is built basically around our three active divisions and wings. Of course, the Congress has decided the size of our ground forces, and our air elements are carefully tailored to support those ground elements.

We seek to provide that support for our fixed ground forces.

As I indicated, the midrange objectives plan is the optimum requirement. Then, this requirement is constrained by asssets in the joint arena, fiscal realities as decided by the Secretary of the Navy and Secretary of Defense.

Senator GOLDWATER. Well, it is obvious that they haven't reached any decision as to what you are going to be looking like 5 years from now. I might say that is par for the course. So we will just have to hope that you are right.

STATUS OF HAYNES BOARD STUDY

A little over a year ago the Marines did a study of how to revise their total force structure, not only ground and air but also to provide more antiarmor capability.

One of the recommendations of that study was to reduce the Marine fighter squadrons from 12 to 9, but to increase Marine artillery tubes. Since that proposal sounds familiar, was it ever implemented or what happened to it?

General MILLER. That study was known as the Haynes Board Study, Mr. Chairman, and part of their recommendation was the deletion of three fighter attack squadrons.

As a result of this study group and after it was analyzed at the headquarters, Marine Corps level which considered all aspects of the requirements to be met, it was decided not to accept that recommendation. The antiarmor capability of three fighter attack squadrons is a significant capability which the Marine Corps could not afford to lose.

Mr. CROMWELL. I have some additional questions we will provide for the record. We would like to have you answer them for the record, and would you also give us a short presentation, for the record, on the AH-1T and OV-10.

Digitized by Google

General MILLER. Yes, sir. The AH–1T and OV–10 statements follow:

AH–1T PROGRAM

The Marine Attack Helicpoter inventory presently consists of twenty single-engine AH–1Gs and sixty twin-engine AH–1Js. The procurement of fifty-seven AH–1T Improved Sea Cobras will allow for replacement of AH–1Gs in the active force, while increasing the total operating inventory [deleted].

The first of two preproduction test AH–1Ts successfully completed Navy Preliminary Evaluation in December 1976 and will undergo structural demonstrations and Reliability and Maintainability performance demonstrations this summer. The second preproduction aircraft, with TOW Missile System installed, was accepted during February and is currently undergoing Operational Test and Evaluation. AH–1T production deliveries are scheduled from October 27 through July 1979. All AH–1Ts will have structural provisions for TOW with the last twenty-three production aircraft incorporating the full TOW Missile System.

his year's funding request for eight AH–1T gunships will complete modernization of the Marine Corps Attack Helicopter Force. The request includes $20.0M in Flyaway Costs, $11.5M in Support and $2.0M for Initial Spares.

OV–10D NIGHT OBSERVATION SYSTEM (NOS) PROGRAM

The OV–10 modification program will convert 18 OV–10A to the OV–10D Night Observation System (NOS) configuration. This program provides for uprating the present 715 SHP T–76 engine to 1,040 SHP, and the addition of a Forward Looking Infra-Red (FLIR) and a Laser Ranger Designator (LRD).

The deployment of this FLIR system will give the Marine Corps their first airborne night observation and surveillance capability. The addition of the LRD will allow the forward air controller airborne to designate targets for laser guided bombs, missiles and laser capable artillery rounds. The uprated engine is required because of the increased drag of the additional systems and to increase the survivability of the aircraft.

The engine uprate development program has been completed. Military Qualification Testing (MQT) on the uprated engine will be completed in April 1977. Production contracts for the engines will be let after successful completion of MQT.

Development contracts for the FLIR and LRD were awarded 30 June 1976. Flight testing of the weapons systems is scheduled to begin in November 1977, and technical and operational evaluation will be completed by 1 July 1978.

First production is scheduled for February 1979 and deliveries will be completed in August 1979.

Senator GOLDWATER. Gentleman, I am sorry but I have to be at another meeting at 10 o'clock. Mr. Cromwell and Mr. Old will continue.

CH–53E REDUCTION

Mr. OLD. Thank you, Senator. General Miller, I have some questions that I would like to pursue on the CH–53 and some of the questions come from a document prepared by the GAO that I am unable to identify any more specifically than that. They are merely questions based upon various weapon systems, that I think it would be well to have the Marine Corps presentation on the record on some of these programs, especially one as important as the CH–53E.

What was the impact on the CH–53E of the $62 million reduction in the revised budget?

General MILLER. The Ford administration budget provided a procurement of six CH–53E. The Carter administration change resulted in a cancellation of that procurement in the amount of $76 million but did provide $14 million in research and development funding in order to maintain the level of industrial effort to keep the CH–53E

Digitized by Google

going and to resolve some further improvement by research and development.

I have Assistant Program Manager, Col. Cliff Reese, here, if you care to address any technical details.

What it will amount to is a 1-year slip in the procurement of CH–53.

Mr. OLD. It apparently was not the Marine Corps' judgment that this 1-year delay in order to catch up with technical problems was required; is that correct?

General MILLER. We did not feel that it was necessary at the time that we submitted the requirement. This will enable us, however, to do some continuous development work to overcome or to provide some improvement primary in the reliability and maintainability of the systems aboard.

Mr. OLD. What is the current estimated program cost versus the original program cost estimate?

General MILLER. Could I provide that for the record, Mr. Old, since we have to be careful how we state it, in which year dollars, and the total cost.

[The information follows:]

The estimated program cost as displayed in the February (Carter) budget is $870.2 million. The original estimate at program initiation was $578.4 million.

Mr. OLD. I am not sure which year dollars these are in, but the document I have says the original projected cost was $578 million, and the new cost is now estimated at $816 million; but, whatever, provide for the record, and the following question is:

How does this increase break out in terms of the inflation, program changes, management errors, and other reasons?

General MILLER. We can break that out for you, sir.

[The information follows:]

The total program increase of 291.8M falls into categories of engineering changes, schedule changes, estimating changes, support changes, and economic/escalation changes. The folowing is a breakout of each category up to the Ford budget of December 1976, and then the additional costs related to the current Carter budget.

	Millions
Engineering and design changes: Includes costs to develop and procure development derived improvements such as uprated transmission, digital automatic flight control system, crashworthy fuel system, IR suppressors, and two point cargo suspension system	$46.1
Schedule changes: Reflects past changes in rate of procurement and 1 year stretch-out of program	27.4
Cost estimating changes: Net reduction from original cost estimates to develop/procure baseline program	−5.8
Support changes: Change in Government furnished equipment support requirements	15.2
Economic/escalation/inflation changes: Impact of escalation on development derived improvements ($17.8M). Schedule changes ($56.9M), cost estimating ($27.6M), support ($38.0M), and higher than anticipated inflation rates ($41.4M)	181.7
Net increase to December 1976	264.6
Carter budget change impact: R&D funding provided to offset cost increase due to deferral of prosurement for one year ($14.0M) and production extension of one year ($13.2M)	27.2
Net increase to present	291.8

Digitized by Google

Mr. OLD. Now, if the program continues to increase, is there a point at which the requirement and possibly other alternatives would have to be evaluated?

[The information follows:]

General MILLER. Periodic reevaluations of the CH–53E requirement and alternatives to satisfying that requirement have been and will continue to be an integral part of the CH–53E development program. The Department of Defense Systems Acquisition process specifically requires a comprehensive review of the program status including reevaluation of the mission requirement and consideration of alternate solutions prior to each major program decision. The next formal review will occur during the first quarter of fiscal year 1978, prior to a Department of Defense decision to commit production funds.

Mr. OLD. Thank you.

It would then be the Marine Corps' position that there are no other helicopters currently in existence that could meet the lift requirement you expect to get from the CH–53E?

[The information follows:]

General MILLER. There are no helicopters in existence or under development in the western world that will match the lift capability of the CH–53E. It is noted however, that the Soviets have had a significant heavy lift capability with the MIL–10K "Harke" for over a decade, and their prototype MIL–V–12 "Homer" has demonstrated a vertical lift capability in excess of [deleted] tons.

The largest United States production helicopter in terms of payload capability is the CH–47 CHINOOK. The Navy extensively studied a notional navalized uprated version of the CH–47 as an alternative to satisfying our heavy lift requirement, but rejected it because of payload limitations (11 tons vice 16 tons for the CH–53E), its lack of commonality with existing systems in our inventory, and the extensive modifications required to make it shipboard compatible.

Mr. OLD. The Marine Corps believes it can still justify the 16–ton lift requirement?

General MILLER. That is correct, particularly in support of our ground forces, where we get an improvement in support of the Marine on the ground by being able to provide him weapon systems in his support in a fast moving tactical situation that cannot be lifted by any other helicopter; in other words, our present capability with the CH–53D allows us to lift only 36 percent of the Marine division's heavy equipment.

While with the CH–53E we will be able to lift 93 percent of that equipment.

Mr. OLD. I have one more question, then in the interest of time we will put the rest of Senator Goldwater's questions in the record.

GAO reports that the CH–53E program was "sold" as a low-risk program that would achieve operation and support cost benefits by having about 60 percent parts' commonalty with the CH–53D.

The report goes on to say, due to changes during development, this will not occur.

Is the GAO correct on that assessment?

General MILLER. To some extent, sir. The aircraft has been changed over this 11-year cycle of development; therefore it has in some areas reduced its commonalty, such as the transmission and rotor head, in

General MILLER. To some extent, sir. The aircraft has been changed over this 11–year cycle of development; therefore it has in some areas reduced its commonalty, such as the transmission and rotor head, in order to improve life cycle cost. The other, the flight control system,

Digitized by Google

which has been further improved in the interest of reliability and maintainability has cut down on the commonalty with the 53 Delta; however, I would state that during the recent trials of the CH–53E at the Naval Air Test Center at Patuxent River, the parts' requirements to support those trials, about 80 percent of those parts have been drawn from the shelf items of those parts that were used to support CH–53D's at Patuxent River; so there is a great deal of commonalty.

Mr. OLD. Maybe for the record the program manager would want to expand and clarify what the percentage is if, in fact, it can be determined?

General MILLER. Thank you, sir. I believe we can.

Mr. OLD. All right. That is all. Thank you.

[The following questions with answers supplied were submitted for the record.]

QUESTIONS SUBMITTED BY SENATOR HOWARD CANNON

[Questions submitted by Senator Howard Cannon, answers supplied by Headquarters Marine Corps:]

Senator CANNON. What percent of the total Navy force structure do the Marine's have in the following areas? Fighters, Light Attack, All-Weather Attack, Reconnaissance, Electronic Warfare?

General MILLER. Marine Corps forces makes up the following portions of the total DON Force Structure:

Functional area:	*Percent of total*
Fighter/attack (VMFA)	33
Light attack (VMA)	33
All-weather attack (VMA/AW)	33
Reconnaissance (VMFP)	38
Electronic warfare (VMAQ)	19

Senator CANNON. Both the U.S. Air Force and carrier Navy use airborne radar warning planes, the AWACS and E–2C. Do you have any airborne radar warning aircraft; and if not, why not? Is it because you don't believe in the concept or don't have a suitable aircraft available?

General MILLER. The Marine Corps uses its ground based radars located with the Marine Air Control Squadron (MACS) in conjunction with the USN carrier based E–2C for radar warning. During the intial phase of an amphibious operation the E–2C furnishes airborne radar warning. Once established ashore, the MACS either alone or supported by the E–2C provides radar coverage of the Amphibious Objective Area. In addition to radar surveillance, the MACs provides airspace management, control of tactical aircraft enroute to their targets, and centralized control of USMC Surface to Air Missiles. The integration of aviation and ground air defense elements and command and control of these elements during amphibious operations and subsequent operations ashore are best accomplished utilizing the ground based control of the MACS.

During periods of operation ashore following the amphibious assault, when E–2C support may not be available, the Marine Corps would welcome E–3A augmentation of the MACS radar coverage.

Senator CANNON. What items in the FY78 budget relate to improving your survivability in a high threat environment?

General MILLER. Numerous joint USN/USMC as well as specific USMC programs are ongoing to enhance TACAIR and helicopter operational capabilities in a mid- to high-intensity environment. Examples of these programs are [deleted]. Other programs that will enhance this capability are [deleted].

A systems shortfall will continue [deleted] however, follow-on funding and new initiatives in the outyears will further enhance our capability [deleted] with Marine Corps TACAIR and helicopters.

There is more we would like to be doing in this area, but again the constrained budget demands trade-offs between improving present capabilities and the procurement of new aircraft. Its a tough management problem at all levels and probably impossible to do to everyones satisfaction.

Digitized by Google

Senator CANNON. How do you assess your capability to fight in NATO Central Europe?

General MILLER. Posed another way, this question asks whether Marine Air-Ground Task Forces can operate successfully on today's mobile, sophisticated battlefield against a heavy armor threat. The question is rephrased in this manner to highlight the monolithic nature of the threat. The allies and surrogates of the U.S.S.R. are all equipped with the same weapons and in similar quantities as the Soviets.

Therefore, irrespective of the differences in methods of force application, the threat confronting each of the four services is similar and is reflected in cooperative sharing of high technology weapons and equipment.

Accordingly, in answer to your question, I would pose the same question about the capabilities of the Army's mechanized division. I am confident we would almost unanimously agree that the Army's mechanized division is designed and equipped to successfully engage this type armored threat. Significantly, a comparison between the Army's mechanized division and a Marine Amphibious Force (MAF) reveals that the real difference lies in the number of tanks in the mechanized division versus the TACAIR available in the MAF. This TACAIR, when correctly employed with the air component of our MAF, possesses the aircraft, weapons, training, and doctrine necessary to be an effective arm of anti-tank warfare and more than compensates for our "lightness" or lack of armors. Generally then, there is an overall equality in capability. The Marine Air-Ground structure is a recognized choice based on a necessary orientation towards the amphibious assault role. This mission direction however, requiring a capability to rapidly embark and move to an objective while dispersed and then build up to combat power from an initial zero capability to fully coordinated self-sustaining striking power ashore, enables Marine Air-Ground Task Forces to responsively deploy and be employed in any combat role.

Senator CANNON. How does your 1978 aviation force structure compare quantitatively with the Joint Chiefs of Staff JSOP objective force? What are your percentage shortfalls in each mission area?

General MILLER. The following figures depict thhe inventory shortfall force compared to the FYDP approved force structure:

Mission area	FYDP 1978	JSOP obj. force [1]	Shortfall
Fighter	[Deleted.]		
Attack			
ECM			
Recon			
TAC (A)			
Refueler			
Heavy helo			
Medium helo			
Light helo			
Attack helo			
Visual recon			

[1] Information extracted/developed from data displayed in JSOP 1979-86.

Senator CANNON. How do your JSOP shortfalls, on a percentage basis, compare with the Navy shortfalls and the Air Force TACAIR shortfalls?

General MILLER. The following table reflects the USM TACAIR shortfalls as compared to the USN and USAF:

Mission area	USMC [1]	USN [1]	USAF [1]
Fighter	[Deleted.]		
Attack			
Recon			
ECM			
TAC			
Refuelers			

[1] Information extracted/developed from data displayed in JSOP 1979-86.
[2] No FYDP funding indicated for the EF-111A.

Digitized by Google

Senator CANNON. In summary, then, the Marines have only two-thirds of the combat aircraft that your studies show are required to support your 3 active divisions. Why haven't you increased your force structure?

General MILLER. Present fiscal and manpower constraints do not permit a force structure increase.

Senator CANNON. Turning to a look at your current capabilities and program status, first, what are your trends in aircraft operational readiness factors and also, what are you doing to improve this area?

General MILLER. A summary of the operational readiness factors for fiscal year 1976, fiscal year TQ, and 1st Qtr fiscal year 1977 (1/77) is as follows:

	OR	FSC	NORS	NORM
Fiscal year 1976	46.8	32.7	28.7	24.5
Fiscal year 19TQ	54.0	42.2	25.6	20.4
January 1977	58.2	46.8	22.6	19.2

FMF aircraft readiness trends reflect improvement in all parameters. This has been the result of increased manning levels, stabilization of units, reorganization of aviation commands, improved funding, micromanagement of constrained resources and emphasis upon flying full systems capable (FSC) aircraft.

Senator CANNON. Why do these OR rates vary so much between aircraft types?

General MILLER. OR rates vary due to the complexity, reliability, maintainability and age of each type, model and series aircraft and the availability of spare parts for support.

Senator CANNON. What additional funding to buy aircraft spares and for spare parts repairs would be required to improve the NORS rates? Would you address this readiness factor?

General MILLER. Aircraft spares are fully funded in fiscal year 1978 for $514.8 million; $78.3 million for initial spares, $53 million for modification spares and $383.5 million for replenishment spares. Spare parts repairs/component rework in fiscal year 1978 is funded at approximately 90 percent of requirements. An additional $51.0 million in this program would meet 100 percent of requirements, provide adequate shelf stock of repairables to further decrease the Not Operationally Ready, Supply (NORS) rate 2-3 percent and increase Fleet Material Readiness 3-5 percent relative to the fiscal year 1977 rates.

Senator CANNON. NORM rates typically are affected by the quantity and quality of your squadron maintenance personnel; in other words, the manning level and also the training status of your maintenance people. Would you discuss these factors as they affect your current and projected NORM rates?

General MILLER. USMC NORM rates have been improving for the past three years and are projected for continued improvement. This improvement has been accomplished by increased emphasis on management of personnel and material assets; improved reliability and maintainability of aircraft and components, and improved training at both the entry level and during practical experience. Manning level, a factor of the authorized allowance of personnel, is based on fiscal constraints. Any reduction of the manning level would adversely affect the NORM rate.

Senator CANNON. How do Marine Corps NORM rates compare with Navy and Air Force rates? My impression is that the Air Force, in particular, is much better.

General MILLER. A comparison of Navy, Air Force and USMC NORM rates for fiscal year 1975, fiscal year 1976, and fiscal year 197T is as follows:

[In percent]

Fiscal year	USN	USAF	USMC
1975	21.5	24.7	25.7
1976	20.4	25.1	24.4
197T	20.2	[1] NA	20.0
197T (F4)	29.9	27.2	30.5

[1] Not available.

Digitized by Google

Senator CANNON. Do your overseas squadron people still deploy for one year unaccompanied tours? What does this do to your reenlistment rates?

General MILLER. The Marine Corps currently meets manning requirements for all its ground forces and nearly all aviation units in the Western Pacific (WestPac) with individual personnel assignments or unit deployments to 12 month tours in which Marines are not allowed to be accompanied by their dependents. This commitment requires that 14 percent of the entire Marine Corps be in a "dependents restricted" status at all times, a proportion of the force far greater than in any other service. This system of individual replacement to WestPac every 12 months also acounts for more than 30 percent of all USMC Permanent Change of Station (PCS) moves and results in a Marine spending from 22 percent to 36 percent of a service career in a "dependent restricted" condition.

Our reenlistment data indicates that nearly 10 percent of our trained and qualified enlisted personnel and approximately 17 percent of our officers leave the service each year because of these protracted, repetitive separations from dependents or loved ones. There is likewise the less definable disaffection with service life caused by the rapid movement of an individual from squadron to squadron as a result of a need to fill vacancies in our CONUS based units generated by other moves to WestPac. These short duration assignments, which are unavoidable considering the magnitude of our requirement for 12 month tours, tend to debilitate morale and therefore contribute to reenlistment problems and exacerbate non-EAS losses.

In recognition of these manpower problems and their associated adverse impact on readiness, we have begun a phased implementation of squadron and detachment deployments as a means of meeting our WestPac commitment. Commencing in 1975 our VMAQ and VMFP detachments commenced 6 month unit deployments from their CONUS homebases to West Pac. Upon completion of the 6 month WestPac tour, the personnel in these units return to their previous duty stations. We also have certain of our squadrons participating in 12 month unit deployments to facilitate relocations in CONUS preparatory to effecting six month unit deployments for these squadrons. Commencing in the first quarter of fiscal year 1978 our Hawaii based F–4 squadrons will begin six month deployments to WestPac concurrent with an initial test of unit deployments for our ground units utilizing a Hawaii based Marine Amphibious Unit (MAU).

These plans for six month unit deployments for both our air and ground units are designed to yield significant manpower efficiencies and improve retention and readiness throughout the Corps. They will likewise serve to drastically reduce Permanent Change of Station moves, costs and dependent dislocations without degrading current force levels in the Western Pacific.

Senator CANNON. General Miller, would you run down your aircraft types once more and tell us where your current program leaves you in good shape, fair shape, and poor shape to meet the likely combat conditions of the early mid-1980's.

General MILLER. The information by aircraft type is as follows:

a. *F–4 Fighter/Attack.*—With the modification of some of these aircraft through the F–4S CILOP, we should be in fair shape until the F-18 is introduced as a replacement.

b. *A–4 and AV–8A Light Attack.*—The AV–8A to AV–8C CILOP should dramatically improve the capabilities of this aircraft for the early 1980's. The 4–M force is in fair shape [deleted]. The introduction of the AV–8B is necessary to solve this problem.

c. *A–6 All Weather Attack.*—With the introduction of the A–6E TRAM aircraft, our all-weather attack force should be in good shape in the early 1980's.

d. *RF–4 Reconnaissance.*—We are completing a CILOP on these aircraft to ensure the force is viable into the late 1980's.

e. *EA–6B Electronic Warfare.*—We are in the process of introducing this aircraft and it is programmed for use into the 1990's.

f. *OV–10 Observation.*—The OV–10D NOS Program will improve the capabilities of this aircraft; however, only half of our OV–10's are being modified due to fiscal constraints. We are in fair shape for the early 1980's.

g. *KC–130 Aerial Refuelers.*—These aircraft have been in the inventory since the late 1950's. We are programming a CILOP for the force which will get us through the early 1980's in fair shape.

h. *UH–1 Command and Control Helicopters.*—This aircraft is fairly new and should be in good shape in the early 1980's.

Digitized by Google

i. *AH–1 Escort Helicopter.*—This aircraft is also fairly new and with the TOW Missile modificaiton should be in good shape for the early 1980's.

j. *CH–46 Assault Transport Helicopter.*—We are planning to modify all our CH–46's to the CH–46E configuration to take us through the 1980's. We should be in good shape in the early 1980's [deleted]. We plan to replace this helicopter and the CH–53 with the VSTOL Type A.

k. *CH–53 Assault Transport Helicopter.*—The situation in this force is identical to the CH–46; however, we plan to dramatically improve our heavy helicopter capability through introduction of limited numbers of the CH–53E.

Senator. CANNON. Your fighter improvement program is to modernize the F–4 with a reliability improvement on the radar and add maneuvering slats and smokeless engines. First, what is the schedule for activating F–4S squadrons and second, how does the F–4S compare as to air-to-air fighter capability with the F–18?

General MILLER. The Marine Corps is scheduled to begin receiving the F–4S in August 1978 and transition will be completed by September 1982. The F–18 will provide some significant improvements over the F–4S in radar detection range, acceleration and agility due to advanced weapons system design, an increased thrust to weight ratio and advanced aerodynamic features of the airplane. Additional air-to-air capability is also gained by the installation of an internal gun and the improved cockpit design of the F–18. Major benefits will also be realized due to the greatly increased reliability and maintainability projected for the airplane. These factors are reflected in significant operating and support cost savings and increased readiness.

Senator CANNON. How does the F–4S compare in air-to-ground capability with the F–18, in terms of range-payload, visual bombing accuracy, and all weather bombing accuracy?

General MILLER. The F–18 has considerably better range-payload characteristics than the F–4S. For a similar mission configuration, the combat radius of the F–18 is about 35% greater than that of the F–4S. The F–4S can physically load and carry more ordnance than the F–18. However, this capability is offset by the superior accuracy of the F–18 air-to-ground weapon system. The aggregate weapons delivery effectiveness of the F–18 is roughly four times better than the F–4S under most conditions. The F–18 system is an aided visual system which will achieve accuracies better than the A–7E in visual and poor weather conditions both day and night. The F–4S depends on air crew inputs and is strictly a visual system. The F–4S has limited night and no all weather capability. The F–18 will be able to acquire targets designated by ground or airborne lasers and will use a Forward Looking Infrared Detector (FLIR) for night operations. The F–4S does not have either of these capabilities.

Senator CANNON. It appears that the F–18 is one of your absolutely vital aircraft programs. How do you feel about that? What position would Marine aviation be placed in if the F–18 program did not work out for some reasons?

General MILLER. The replacement of our aging F–4 force is absolutely vital. The increased capability and readiness that will be provided by the F–18 as well as the projected manpower and ownership cost savings that are associated with the airplane are urgently required to improve readiness force wide.

If for some reason the F–18 program doesn't work out then we will once more have to review all of our alternatives. This review would necessarily focus on those fighters in or near production and would consider the ability to operate in an austere environment, compatibility with USN/USMC requirement for carrier and SATS field operation and the effect on overall Marine Corps readiness. With these factors in mind, loss of the F–18 would be a significant blow to future USMC fighter capability since we have already gone through a careful review and elimination process to arrive at the F–18 for the Marine Corps.

Senator CANNON. How does the F–18 compare with the AV–8B in terms of air-to-ground range-payload and in terms of air-to-air fighter capability?

General MILLER. The comparison of the F–18 and the AV–8B in terms of air-to-ground range-payload and in terms of air-to-air fighter capability reflects what these two different aircraft are primarily designed for and how the Marine Corps plan to utilize them.

In air-to-ground capability, the AV–8B and F–18 are closely comparable for the larger ordnance payoads at combat radii of 200 miles or less. The AV–8B, operating from austere forward bases with a maximum of 1200 to 1500 ft of runway, provides minimum response time and maximum flexibility for this close

Digitized by Google

mission, the F–18 can carry more payload than the AV–8B. This reflects the air support range band. At the greater distances, more typical of the interdiction design goals of the F–18 as the Navy/Marine Corps strike-fighter.

In terms of air-to-air fighter capability, the issue is clear cut. The F–18 is designed for the fighter mission and will have supersonic speed capability, an air-to-air radar system, a beyond-visual-range (BVR) all weather missile and aircraft cannon. The AV–8B, on the other hand, has the primary mission of ground attack and carries only two Sidewinder infrared missiles and aircraft cannon for possible air-to-air use. While this combination of missiles and cannon, coupled with the high thrust and thrust vectoring of the AV–8B engine, give the AV–8B a formidible self defense capability, it does not give the AV–8B the capability to be a primary fighter aircraft.

From the Marine Corps viewpoint, the F–18 and the AV–8B capabilities complement each other. The AV–8B will be the primary light attack aircraft in the immediate objective area. The F–18 will be the primary fighter aircraft in the objective area. Each, however, can reinforce the other when conditions warrant. The F–18 air-to-ground capability will be of immense value when needed for an extra air-to-ground effort and the AV–8B air-to-air capability will be available in times of increased air threat to the amphibious force.

Senator CANNON. What sensors will the RF–4B use in common with the Air Force RF–4C and which ones will be different?

General MILLER. The APD–10 Side Looking Radar, AAD–5 Infra Red Detecting Set, KS–87B framing camera and the KA–56 low altitude panoramic camera are common to the Air Force RF–4C. The Air Force uses a KA–91B high altitude panoramic camera while the Marine RF–4B will use the KS–116. Although different in focal length and therefore constructed slightly different due to space constraints, parts for the two cameras are 85 percent common.

Senator CANNON. Why don't you use their UPD–4 SLAR?

General MILLER. We will use the UPD–4. The UPD–4 consists of two elements, the APD–10 which is the airborne portion of the system, and the ES–83 correlator processor which is the ground portion.

Senator CANNON. Are the Marines following the Air Force's Quick Strike Reconnaissance and other RF–4 improvement programs? Will you adopt any of them?

General MILLER. Yes we are. We are quite interested in their Tactical Electronic Reconnaissance (TEREC) system. We feel that the RF–4B has ample mission growth and would be an excellent vehicle to utilize the TEREC system.

Senator CANNON. What is the status of your DECM jamming capability? Are you satisfied with the current systems?

General MILLER. The majority of the Marine Corps TACAIR assets are currently configured for the ALQ–126 DECM system. The ALQ–126 will remain the Navy/Marine Corps prime DECM system until the mid–1980's. The last programmed deliveries of the ALQ–126 systems and the associated support equipment over the next two years will significantly enhance the material readiness of Marine Corps units in this vital area. [Deleted.]

Senator CANNON. Are there any near term ways to improve this situation, such as using Air Force pod systems?

General MILLER. The use of pods is being explored since the expected DECM [deleted] situation created by the ALQ–126 [deleted] will be most pronounced in the early 1980's, just prior to the introduction of the next generation internal system. The adaptive ECM pod being developed for the AV–8 aircraft appears to be the promising solution.

Senator CANNON. Why is a new jamming pod being developed for the AV–8 Harriers?

General MILLER. The peculiar weight and space constraints of the AV–8 dictate that the jamming system be installed in a pod capable of being mounted on the centerline store station of the aircraft. There are no pods in the Air Force or Navy inventories that will meet the critical space constraints of this store station. The system under development will utilize the most capable off-the-shelf avionics repackaged in a pod that meets the physical requirements of the AV–8. The system is being designed specifically for the AV–8 but will be capable of being carried by other TACAIR assets.

Senator CANNON. What radar warning system does the Harrier use?

General MILLER. [Deleted.] Systems under consideration for retrofit include the ALR–66 which is in the LAMPS helicopters, or the new ALR–67 processor

95-35 - O - 77 - 20

Digitized by Google

with a compatible receiver. Either of these approaches would provide the desired capability and maintain commonality with other Navy/Marine aircraft.

Senator CANNON. What airplanes will the CT–X replace in the Marine inventory?

General MILLER. The airplanes replaced by the CT–X are old, obsolete reciprocating engine transport/utility types varying in age from 16.4 to 32.9 years. These aircraft are: C–117's, C–118's, C–131's, U–11's and US–2's.

Senator CANNON. What is your personal opinion on what kind of a plane should fill this mission need?

General MILLER. The CTX minimum characteristics should include: 235 knots (TAS) minimum cruise speed, 8–18 passenger capacity, capability to lift 1000 pounds of cargo a distance of 1000 nautical miles, maximum takeoff gross weight of 20,000 pounds, takoff and landing distance of 4000 feet. It should be an off-the-shelf commercial turbined powered aircraft. A desirable capability and a factor in selection is a cargo door capable of accommodating standard 40x48 inch cargo pallets. As envisioned, the CT–X procurement will include contractor maintenance and logistic support.

Senator CANNON. Colonel Lewis, what is your overall assessment of your technical status this year? Are there any increase or decreases in capabilities of the projected AV–8B airplane during the last year? Also, are there any outstanding technical problem areas on the AV–8B at this point in time?

Colonel LEWIS. The AV–8B development program has made excellent progress during the past year. The full scale wind tunnel tests are now complete and the results are slightly more favorable than we predicted. Our payload range estimates for both vertical and short take-off missions are confirmed by the NASA Ames test data. The composite wing structural test results show a very safe design margin, and we may be able to obtain a further weight savings compared to a metal design. Our initial weight savings estimate was 330 pounds, and this could go up to 360 pounds. As of this date, we have no technical problem areas.

Senator CANNON. When you say the AV–8B will have a 100% increase in range payload over the AV–8A, are you referring to VTO or STO performance?

Colonel LEWIS. The 100 percent figure is an average figure for typical close air support missions. The actual number varies with payload and mode of take-off. The following table shows some specific examples:

Mission	AV–8A capability	AV–8B capability	Percent increase
Vertical take-off performance: Tropical day conditions	[Deleted.]		
Short take-off performance: 1,000-ft roll, tropical day conditions			

In summary, over the spectrum of typical close air support ranges or payloads, the AV–8B performance averages out to about a 100 percent increase over the AV–8A.

Senator CANNON. Why was the R. & D. program srtetched out since last year? Did the technical risk increase, was it a shortage of annual funds available, or what was the reason?

Colonel LEWIS. The AV–8B R. & D. program has not stretched since last year. The review by the DSARC recommended delay of production by one year to reduce the amount of concurrency between the development schedule and the production schedule. Hopefully, this would reduce any potential risk of a large number of engineering changes that could be required in the pilot production aircraft. Since the production line will be shut down for one year, we considered it prudent to add two more development aircraft for Independent Operational Testing (I.O.T. & E.).

Senator CANNON. Would you provide for the record specific performance comparisons of the AV–8A, AV–8B, A–4M, A–7E, and F–18 in the air-to-ground mission for several representative combat payloads such as 6 Mk–82 500 lb bombs, 4 Mk–83 1000 lb bombs, or whatever would be typical operationally useable loads?

Colonel LEWIS. Combat radii for the close air support mission and a strike mission (Hi-Lo-Lo-Hi) are as follows:

Digitized by Google

Close air support mission: 1-hour loiter in target area, 4,000 ft. runway maximum [deleted].

Strike Mission: Hi-Lo-Lo-Hi, 4,000 ft runway maximum [deleted].

QUESTIONS SUBMITTED BY SENATOR BARRY GOLDWATER

[Questions submitted by Senator Barry Goldwater, answers supplied by Headquarters Marine Corps:]

Senator GOLDWATER. The GAO reports that the CH–53E program was "sold" as a low-risk program that would achieve operation and support cost benefits by having about 60 percent parts commonality with the CH–53D. The report goes on to say that due to changes during development, this will not occur.

Is the GAO correct on this assessment?

What is the significance in terms of life cycle cost estimates?

How does this impact on the projected procurement cost of the CH–53E?

General MILLER. There have been conscious, deliberate actions to reduce commonality in specific areas in order to reduce the cost of ownership. The CH–53E is still 41.5 percent generically common to the earlier H–53 series aircraft. For example the growth transmission which will be incorporated in production aircraft is expected to reduce life cycle cost by $25 million and procurement cost will be reduced $5.6 million, primarily due to a reduced requirement for investment spares. The digital automatic flight control system should reduce life cycle cost by $30 million and procurement cost by $4.5 million, primarily due to a reduced requirement for peculiar ground support equipment. The government furnished electronics suite has been replaced with currently procured solid state components instead of the older tube-type components in prior H–53 series helicopters. The newer electronics components exhibit a quantum increase in reliability when compared with the components in earlier H–53's, thus reducing operating and support costs and life cycle costs.

Senator GOLDWATER. Will the uprated transmission and the digital Automatic Flight Control System testing dovetail with the now planned production schedule? Is there any unnecessary concurrency with these two systems?

General MILLER. Yes, the testing of the uprated transmission and digital automatic flight control system will dovetail with the production schedule. There is no program concurrency.

Senator GOLDWATER. The GAO report refers to the structural oscillation that occurred at less than maximum speed when carrying internal loads with a forward center of gravity. Has that problem been solved or is its solution in hand?

General MILLER. The subject oscillation results of an undesirable interaction between the rotor system and engines. As is standard cight test procedure, the flight envelope has been expanded judiciously as testing shows that adequate margin exists between potentially hazardous areas and normal operating conditions. For the current testing, the maximum speed is set at 150 knots at greater than 56,000 pounds gross weight and, 170 knots when operating at less than 56.000 pounds gross weight. These limits correspond to the operational requirements and therefore have no impact on mission effectiveness. The Navy's interest in eliminating the vibration phenomenon is one of safety margin; to insure that operational pilots are unable to inadvertently induce the condition.

Testing has shown that a modification to the engine fuel control will eliminate the problem. The modification will be incorporated following current Board-of-Inspection and Survey testing.

Senator GOLDWATER. The GAO report also refers to a potential problem caused by extreme downwash and gust velocities when approaching to hover over a ship, to the point that damage might be caused to other aircraft and personnel might not be able to perform their duties. Is this a serious problem or is more testing required before you will know the answer?

General MILLER. The downwash and gust velocities of the CH–53E do not constitute a serious problem; no further testing is required. 1977 Board of Inspection and Survey and Operational Tests have shown that downwash problems have not been as severe as anticipated. Utilizing proper procedures, personnel have been able to perform normal duties when beneath the aircraft, whether ashore or aboard ship. With respect to possible damage to stowed aircraft, the potential is similar to that of heavily loaded H–46's or C/RH–53D's now in daily operations.

Digitized by Google

Senator GOLDWATER. What is the total inventory requirement for the CH–53E?

General MILLER. The total inventory requirement is for 70 aircraft, 35 for the Navy and 35 for the Marine Corps.

Senator GOLDWATER. Has the Army indicated any further interest in the CH–53E Program?

General MILLER. The Army considered the CH–53E as an alternative to the CH–47A and B modernization program. While acknowledging the increased productivity of the CH–53E, the Army concluded that modernization of their existing CH–47 fleet provided the most cost effective solution to satisfying their less demanding requirement for a 15,000 lb payload capability at 4000 ft 95°F ambient conditions. The Army has not formally expressed any further interest in the CH–53E since this decision.

Senator GOLDWATER. Since acquisition cost is now estimated at $870.2 million, should the requirement and possible alternatives be reevaluated?

General MILLER. The Naval Air Development Center was tasked in November 1976 to conduct an extensive review of the mission requirements for the heavy lift helicopter including a cost effectiveness analysis of various alternatives. The results of that effort, promulgated in March of this year, revalidated the mission requirement and determined that the CH–53E was still the most cost effective alternative.

Senator GOLDWATER. What has been done to update cost effectiveness comparisons with other heavy lift helicopters in operation?

General MILLER. Frequent reevaluations of the CH–53E requirement and alternatives to satisfying the requirement have been and will continue to be an integral part of the CH–53E development program. In addition to comprehensive program reviews prior to each major milestone decision, periodic studies are directed by the sponsor to specifically reevaluate the mission requirement and make cost effectiveness comparisons of alternative solutions. In the case of the CH–53E, studies have been undertaken every year since prototype development approval was received in 1973. Participating activities have included the Center for Naval Analysis, the Marine Corps Development and Education Command, the Advanced Systems Division of the Naval Air Systems Command, and the Naval Air Development Center. Results of the last study, undertaken by the Naval Air Development Center and promulgated in March of this year, again confirmed that the CH–53E was the most cost effective alternative to satisfying the Navy/Marine Corps heavy lift requirement.

Senator GOLDWATER. What types of cargo must be lifted that cannot be partially disassembled for transport by operational helicopters with less left capability?

General MILLER. There are approximately 1,400 individual items of equipment in a Marine amphibious force that exceed the payload capability of the CH–53D and so require disassembly prior to helo-transport. The items cover a wide range and include direct combat support equipment, combat engineering support equipment, logistics support equipment, and aviation support equipment. All but 149 of these items are air transportable by the CH–53E without disassembly. In the technical sense, all of the items could be disassembled for CH–53D air transport. The desirability of doing so, however, would depend entirely upon the operational situation. For example, the requirement to establish fire support bases as quickly as possible requires that the engineering support equipment and the guns themselves be air transported intact to the desired location, often an otherwise inaccessable hilltop site. Assembly of the equipment at the site would be extremely difficult at best, and impossible under combat conditions. Considering combat logistic support: In order to make maximum use of limited amphibious shipping, the assault force trucks are preloaded with standard combat loads of ammunition, food, medical supplies and the like. To remove the loads prior to moving the trucks would consume valuable time and be extremely difficult under constrained shipboard conditions. Two airlifts would then be required to transport the vehicle and its separate load ashore. Once ashore, additional time and manpower would be required to remarry the load. Finally, the truck would still face terrain obstacles in making its way to its ultimate destination. Similar examples include the movement of heavy equipment for forward site preparation for the AV–8 Harriers, the timely repair of road and bridge facilities to allow rapid continuance of the assault, and the movement of equipments to expeditiously repair or establish expeditionary airfields before road networks have been made suitable for surface transport. The lift capability of the CH–53E allows the loads to be carried intact, using only a single aircraft, and to be delivered where and

Digitized by Google

when the assault force commander neds it, without hindrance from terrain obstacles.

Senator GOLDWATER. The CH–53E program was "sold" as a low risk program that would achieve operation and support cost benefits by having considerable (60 percent) parts commonality with the CH–53D. However, because of design changes during development, the commonality has been reduced to the point where the CH–53E more closely resembles a new aircraft than a modified CH–53D. What has been the effect on operating and support costs? How does this impact on life cycle costs?

General MILLER. Operating and support costs and life cycle costs are being reduced by design changes which reduce commonality with older H–53 series helicopters. Cost of ownership is being reduced because management action is taken to insure that any design change which reduces commonality replaces a common component or system with one which is more reliable than its predecessor. The effect of this effort is evidenced in the Navy testing currently underway at Patuxent River, Maryland and Quantico, Virginia. Although slightly less than 50 percent of the part numbers on the CH–53E are common to earlier H–53's, 80 percent of the parts being replaced during normal maintenance are common parts, indicating the non-common parts are more reliable than the common parts.

Senator GOLDWATER. How much additional training will have to be provided to CH–53D maintenance personnel?

General MILLER. Marines experienced in CH–53A and D maintenance are currently maintaining the two production prototypes at Patuxent River, Maryland and Quantico, Virginia without difficulty. These personnel received two to five weeks familiarization training on the differences between the CH–53E and CH–53D. When the CH–53E is fielded, all maintenance personnel will receive the same initial training as those who maintain the CH–53D. They will then attend the same Naval Air Maintenance training detachment as CH–53D personnel and their courses of instruction will be of the same duration. In the specific area of the automatic flight control system, CH–53E technicians are expected to require less training than their counterparts on the CH–53D. In summary, the training requirements for CH–53E maintenance will be equal to or less than that of the CH–53D.

Senator GOLDWATER. How does the current 11.0 million unit procurement cost of the CH–53E compare with the unit cost of the CH–53D?

General MILLER. The current estimate of the average unit cost of the 70 CH–53E helicopters the Navy Department plans to procure is $7.2 million in 1977 dollars. A comparable unit price estimate for a like number of new procurement CH–53D's built to current specifications and delivered in the same timeframe is $6.5 million. The $11.0 million referred to in the question is an estimate program unit cost of the CH–53E in escalated (then year) dollars and includes all R.D.T. & E. and all support costs as well as aircraft costs.

Senator GOLDWATER. DOD approved a restructured CH–53E acquisition plan on August 30, 1976. The plan provides for $33 million of procurement funds for long-lead items to be released in April 1977. According to the Commander, Operational Test and Evaluation Force (COMOPTEVFOR), this is the critical milestone for production commitment.

The need for an uprated transmission and digital Automatic Flight Control System (AFCS) led to extending the CH–53E development and restructuring the program. However, flight testing of both subsystems is not scheduled until after April 1977. Why are funds planned to be committed for production prior to flight testing of the uprated transmission and digital AFCS? When will OPTEVFOR determine the operational suitability of the uprated transmission and digital AFCS?

General MILLER. Based on the PBD of Feb 1977, the release of production funds is not planned until April 1978. The digital AFCS and the uprated transmission will begin flight tests in mid 1977. With delivery of first aircraft planned for April 1980, there is adequate time to test and modify, if required, prior to fleet delivery.

COMOPTEVFOR will test the uprated transmission and digital AFCS in June of 1978.

Senator GOLDWATER. CH–53E procurement funds for fiscal year 1978 are being requested nearly a year before they are actually needed. Long-lead time funds are scheduled for release when the Defense Systems Acquisition Review Council (DSARC) authorizes limited production in January 1978. The balance is sched-

Digitized by Google

uled for release in August 1978 at the time of the DSARC full-scale production decision. With a 2-month schedule slippage, the DSARC decision will not be made until fiscal year 1979. Can the fiscal year 1978 procurement appropriation be eliminated without impacting on program cost and scheduled deliveries to the fleet?

General MILLER. The fiscal year 1978 procurement request has been deleted by the new administration. The fiscal year 1977 funds will not be released until after Navy flight testing of the growth transmission and digital automatic flight control system. The Navy Department now plans to let the contract for the six production aircraft to be procured with fiscal year 1977 funds after DSARC III scheduled in January 1978, and no later than April 1978. This is 9 to 12 months later than originally planned. The delivery of the initial six aircraft will be planned to end just prior to commencement of the fiscal year 1979 deliveries to prevent a costly production line gap.

The current budget provides funds in the amount of $27.2 million ($14 million R. & D. and $13.2 million procurement) to cover increased costs due to the fiscal year 1978 production deletion. The project manager indicates funds provided may not be sufficient to complete the restructured program. A detailed analysis of the exact cost impact is underway and will be reported in the March 1977 selected acquisition report.

Senator GOLDWATER. Recent contractor testing disclosed severe structural oscillations at less than maximum speed when carrying internal loads with a forward center of gravity. Unless the pilot slows the aircraft, the oscillations become increasingly severe and could eventually destroy the aircraft in flight. This problem has led to restrictions on the performance envelope during Navy Preliminary Evaluation III, completed in September 1976, and Bureau of Inspection Survey Trials, which are currently in progress. Does the Navy plan to have this problem solved prior to seeking a production commitment?

General MILLER. Yes, the Navy plans to have this problem solved prior to seeking a production commitment. Currently two alternative solutions have been identified. The first (and preferred) will be flight evaluated during the 3rd quarter of fiscal year 1977. The remaining alternative can be flight tested during the 2nd quarter of fiscal year 1978.

Senator GOLDWATER. If a solution is not possible prior to production. What limitations will be imposed on CH-53E pilots to prevent is occurrance and what limitations will be imposed on the loading crews?

General MILLER. If a solution is not possible prior to production, the flight envelope will be restricted to 150 knots or less for gross weights above 56,000 pounds and 170 knots for lower weights. This will have no impact on external load operations since load stability generally limits airspeed to 120 or less. The impact of such a restriction on internally loaded operations is marginal since best range airspeeds are approximately 130–135 knots. No limtiations will be placed on loading crews, as testing has shown that center-of-gravity position has no influence on the vibration.

Senator GOLDWATER. Operational Test reports noted a potential problem caused by extreme CH-54E downwash and gust velocities when approaching to hover over a ship. In addition to possible damage to blades of other aircraft, personnel exposed to the downwash may not be able to perform their duties. Since shipboard testing has not yet been conducted, has the Navy assessed the significance of the problem? Will the problem be assessed during BIS Trials and Operational Testing?

General MILLER. Board of Inspection and Survey (BIS) Trials commenced November 20, 1976; Operational Testing commenced January 6, 1977. These tests have shown that downwash problems have not been as severe as anticipated. Utilizing proper procedures, personnel have been able to perform normal duties when beneath the aircraft, whether ashore or aboard ship. With respect to possible damage to stowed aircraft, the potential is similar to that of heavily loaded H-46's or C/RH-53D's now in daily operations.

Senator GOLDWATER. The static charge buildup in the CH-53E is potentially fatal to ground personnel who grasp the cargo hook before the aircraft can ground itself. The problem exists to a lesser degree with other helicopters in operation today. The Navy has found a temporary solution to the problem. How

Digitized by Google

well does this temporary solution work in operational conditions and how does the ground crew determine when the aircraft is safely discharged?

General MILLER. The solution to grounding the CH–53E is not a temporary procedure devised solely for CH–53E. Direct grounding of the helicopter is standard practice in helicopter external load operations. Under operational conditions ashore and aboard ship, the CH–53E has satisfactorily been discharged by directly grounding the aircraft.

Under operational conditions, the crew grounds the cargo hook prior to its engagement. In a passive system, the aircraft static charge level cannot be determined. Therefore, operational procedures have been devised in which the ground crew maintains contact between the cargo hook and the grounding device. These procedures, developed in the early 1960's, have been effective in protecting personnel from any potential hazard.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

[Questions submitted by Senator Strom Thurmond, answers supplied by Headquarters Marine Corps:]

Senator THURMOND. Colonel, you describe the AV–8B as a light attack aircraft. Also, the A–4 is light attack. What definition do the Marines apply to a "light attack" airplane.

Colonel LEWIS. "Light attack" is a naval term used in carrier aviation to describe the general size/weight of an aircraft. Aircraft in the "light attack" class are the A–4, A–7, and AV–8. An aircraft on the "medium attack" class is the A–6 and aircraft of the "heavy attack" class are the A–3 and A–5.

Senator THURMOND. What has been the maintenance record for the Harrier?

Colonel LEWIS. The AV–8A maintenance record for the period fiscal year 1975 through fiscal year 197T indicates that an average of 22.7 percent NORM and 30.5 Direct Maintenance Manhours per Flight Hour (DMMH/FH) were reported. The averages for fiscal year 1975, fiscal year 1976 and fiscal year 197T are as follows:

	Norm (percent)	DMMH/FH (hours)
Fiscal year 1975	22.0	28.2
Fiscal year 1976	26.0	25.8
Fiscal year 1977	22.3	32.7

Senator THURMOND. List for the record the improvements and costs for the AV–8B and the capability increase resulting therefrom?

Colonel LEWIS. It is difficult to allocate total cost of elements of the new design. The major cost in a development program is the assembly, ground test and flight test of the complete aircraft, including associated reliability and maintainability engineering. We have provided below an estimate of the design and tooling cost appropriate to the primary performance improvement features.

Design features	Payload improvement (pounds)		Design and tooling cost
	VTO	STO	
Super lift wing	0	6,700	$34.0M
Revised inlet	600	700	4.5M
LIDS	1,200	0	3.2M

Senator THURMOND. Why is the AV–8B not suitable for the Navy's new proposed carriers which are looking to new V/STOL technology in order to have really effective planes?

Digitized by Google

General MILLER. This is a question that would be more appropriately answered by the Navy; however, from a purely operational standpoint, the AV–8B will be capable of conducting routine flights from the Navy's carriers of the future. It will be compatible with all of the new proposed ships that are intended for V/STOL operations. It is not missionized for the anti-submarine or airborne early warning roles that the Type A aircraft will fulfill.

Senator THURMOND. General Miller, is your update of Marine aircraft instead of procurement based entirely on budget constraints?

General MILLER. Our fiscal year 1978 Aircraft Procurement Request represents a carefully balanced program between new procurement and the update of existing airframes to support our projected force level requirements. It is acknowledged that fiscal realities has greatly influenced our procurement request and I cannot deny that we would like to procure selected aircraft at a greater rate. I would also like to point out that the present update program represents only those items which are considered essential to maintain force levels. There are other programs which are considered high priority but remains unfunded.

Senator THURMOND. What is the cost of the all-weather A–6 and what is its replacement down the road?

General MILLER. The fiscal year 1978 flyaway cost of the A–6E aircraft with Target Recognition and Attack Multisensor (TRAM) installed is 11.5 million dollars. The A–6E TRAM is the configuration which best meets the current Marine Corps requirements for all-weather attack and will continue to meet these requirements into the 1980's. During April 1976 DON initiated an effort to define an A–6 replacement, called the Advanced All-Weather Medium Attack Aircraft (VAMX). During Nov 1976 the VAMX effort was halted pending a reexamination of the Advanced All-Weather Medium Attack Aircraft replacement/modernization requirements.

Senator THURMOND. You described the A–4 as less expensive and simpler. What was its program unit cost for the last buy?

General MILLER. The last 24 A–4M's were procured at a Program Unit Cost of $4.3 million. The total buy of 141 A–4M's were procured at a Program Unit Cost of $2.8 million. The increased unit cost over prior year buys is attributable to the ARBS configuration, and increased Landing Weight.

Senator THURMOND. What degree of bomb accuracy improvement will be gained by the Angle Rate Bombing System (ARBS) for the A–4?

General MILLER. The A–4M without the ARBS is a [deleted] weapons delivery system. With the ARBS installed the A–4M has demonstrated a [deleted] capability. The ARBS also gives the A–4M a [deleted] system increasing the stand-off identification/target acquisition capability.

Mr. CROMWELL. We will take a short recess and then take up the Navy shipboard SAM program.

[Short recess.]

NAVY SHIPBOARD SAM PROGRAMS

Mr. CROMWELL. Continuing the second half of this hearing, the principal witness for the Navy shipboard SAM program is Vice Admiral Doyle, Deputy Chief of Naval Operations for Surface Warfare; and he is accompanied by Rear Admiral Rowden, Rear Admiral Carter and Rear Admiral Meyer, plus the various supporting witnesses and program managers.

I would like to start off asking questions on the Aegis.

Digitized by Google

STATEMENT OF VICE ADM. J. H. DOYLE, JR., U.S. NAVY, DEPUTY CHIEF OF NAVAL OPERATIONS, SURFACE WARFARE; ACCOMPANIED BY REAR ADM. W. H. ROWDEN, U.S. NAVY, DIRECTOR, SURFACE COMBAT SYSTEMS DIVISION, OFFICE OF CHIEF OF NAVAL OPERATIONS; REAR ADM. E. W. CARTER, U.S. NAVY, DEPUTY COMMANDER, WEAPON SYSTEMS ENGINEERING DIRECTORATE, NAVAL SEA SYSTEMS COMMAND; REAR ADM. W. E. MEYER, U.S. NAVY, AEGIS PROJECT MANAGER, NAVAL SEA SYSTEMS COMMAND; CAPT. T. R. MATHIS, U.S. NAVY, ASMD PROJECT MANAGER, ACTING, NAVAL SEA SYSTEMS COMMAND; CAPT. R. R. HATCH, U.S. NAVY, DIRECTOR, MEDIUM-RANGE MISSILE SYSTEMS DIVISION, NAVAL SEA SYSTEMS COMMAND; COMDR. G. R. MEINIG, U.S. NAVY, CIWS, PHALANX, PROJECT MANAGER, NAVAL SEA SYSTEMS COMMAND; AND COMDR. A. S. MOBLEY, U.S. NAVY, SIRCS PROJECT MANAGER, NAVAL SEA SYSTEMS COMMAND

Admiral DOYLE. I will submit my statement for the record at this time along with the opening statements of Admiral Rowden and Admiral Meyer.

Mr. CROMWELL. Would you put all the statements in the record.

Admiral DOYLE. Yes, sir.

[The prepared statement of Vice Admiral Doyle follows:

OVERVIEW OF NAVY SHIPBOARD FLEET AIR DEFENSE

Thank you Mr. Chairman, I am Vice Admiral Doyle, deputy chief of Naval operations for surface warfare. My purpose today is to present the Navy's shipboard fleet air defense programs for fiscal year 1978. Here to assist me are Rear Admiral Rowden, director of the surface combat systems division in my office, Rear Admiral Carter, deputy commander, naval sea systems command for weapon systems engineering, Rear Admiral Meyer, the Aegis program manager, Captain Mathis, the ASMD program manager and the appropriate project managers from the naval sea systems command.

All briefings are classified. I have a detailed statement which I would like to submit for inclusion in the record.

My opening remarks will provide an overview of the process by which the Navy determines its force structure requirements. This brief discussion will serve as a preface to the detailed presentation of the Navy's shipboard air defense program.

Naval Forces are hardware and technology intensive. They require large capital investment, 5 to 15 years lead time from concept approval to fleet introduction, and have an operational life span of 20 to 30 years. Ships built today will be a significant part of the fleet in the early twenty-first century. Present naval leadership has little control over the current force structure of the fleet, because the ships and aircraft in the active fleet today and those about to enter the fleet were authorized and funded many years ago. Responsibility for future readiness lies, in part, in the development and procurement actions started now which will shape the character of the fleet in the period from 5 to 35 years in the future.

The future force structure of the Navy is determined by interdependent, comprehensive consideration of three basic factors: Strategy, threat, and risk. As they affect the Navy, these factors can be defined as follows. First, strategy which is the national strategy which the naval force structure will be called upon to support.

Digitized by Google

Second, the threat, which is the military force and weapons technology which the Navy force structure will encounter in carrying out its responsibilities within the national military strategy.

The final factor is risk, the degree of assurance that the Navy can successfully execute its responsibilities in support of the national military strategy.

Naval requirements are expressed in terms of military characteristics of individual ships and aircraft, and in the force levels represented by those ships and aircraft. The combination of military characteristics and force levels constitute force structure. Force structure in combination with readiness represents the capability of the fleet. As expressed by the Congress in title 10, U.S. code, the basic mission of the Navy is to conduct prompt and sustained combat operations at sea in support of national policies. To provide the required support of U.S. national military strategy, the Navy needs enough ships, aircraft and people to constitute a balanced fleet, which in coordination with other services and in combination with allies, can accomplish this mission in the face of the total maritime forces of potential adversaries.

The U.S. Navy must be able to fight against a broad spectrum of weapons and win. If it is to carry out successfully all of the naval warfare tasks, it cannot make the mistake of overemphasizing any single area of naval capability. To do so would invite the enemy to exploit an area of neglect.

Within the realities of a constrained budget, there must also be a balance between very capable multi-purpose ships such as carriers and cruisers, which are relatively expensive, and less capable vessels which, being less costly, can be procured in larger quantities, providing the fleet with the density of force it needs to be effective on a worldwide basis.

The process by which future naval force requirements are determined is both simple in concept and complex in execution. Starting with national military strategy, forces which have been approved and will reach the fleet within the time period under consideration are added, and those units which will reach the end of their useful service life are deleted in order to accurately predict future force structure. The capabilities of these forces are evaluated against the expected threat, and the ability of the U.S. Navy to carry out its functions of sea control and power projection is assessed in various scenarios. Significant uncertainties and judgemental factors are an integral part of this continuing process. The final and most difficult step is to determine the number, type and mix of ships and aircraft needed to correct deficiencies in our forces and minimize risks, keeping in mind the requirement to maintain balanced force levels and fiscal realism. If the proper strategy is projected, the threat correct assessed, and risk accurately identified, uncertainty can be minimized and naval requirements can be established.

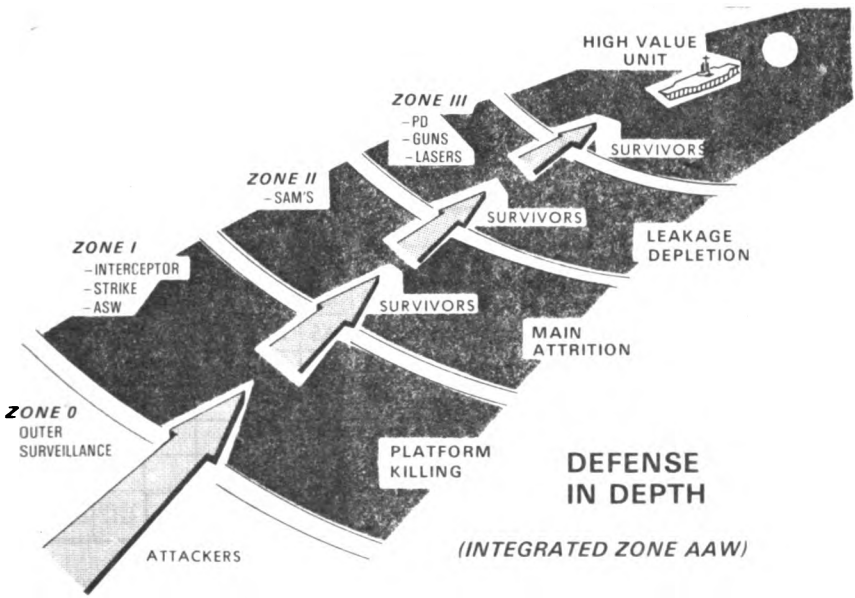
In general, this process results in programs which are intended to improve our capability—that is, building on what we have in inventory and structuring developments such that they address shortfalls we identify with respect to the threat. In the fiscal year 1978 shipboard air defense program which we are presenting this morning AAW (area defense) improvements have been given high priority reflecting our concern over the rapidly advancing capabilities of the Soviet cruise missile threat. Our principal objective are: first, to restore complete coverage throughout all zones of "defense in depth" and second, to enable our surface combatants operating in task groups to contribute more effectively in air defense; and third, improve the offensive and defensive capability of surface combatants operating outside the umbrella of carrier aircraft.

Fleet air defense is one of the functional warfare tasks that the Navy must be able to successfully execute in order to perform its primary functions of sea control and power projection. This function has two major components—carrier-based aircraft and shipboard weapons systems. Today's presentation will address the latter. Following the detailed presentations of specific systems, I will be more than happy to expand on any of the elements of fleet air defense you desire.

PREPARED STATEMENT OF REAR ADMIRAL ROWDEN

Good morning, Mr. Chairman. Our fleet air defense programs have been developed based on a concept we call defense in depth which consists of three principal air defense zones around the task force as illustrated in this viewgraph.

Digitized by Google



Defense in depth against a massive, near simultaneous attack on a group of ships begins with area defense measures to detect and dilute such an attack down to manageable proportions and concludes with the use of self-defense systems on the targeted ships. Defensive measures are comprised of: first, detection for early warning and identification of targets; second, deception, to cause the missile to head for the wrong targets; third, disruption—to cause the missile to be aborted either by causing it to lose its homing logic or by throwing it off its attack course, and finally, destruction of the missile which is accomplished by either neutralizing the launching platform, or destroying the missile in flight.

Detection begins with carrier-based air and search radars organic to naval forces. This combination is a complementary set of systems designed to insure that our offensive and defensive operations begin at the earliest possible moment of any attack. The F–4, and F–14 with the Phoenix missile, in conjunction with airborne early warning aircraft, have the capability to operate beyond the effective ranges of our surface-to-air missiles in the outermost air defense zone.

Since no set of defenses is perfect, some threats will penetrate the outer defense zone and we must therefore provide for a hard kill surface-to-air capability in the middle and inner air defense zones. It is this capability that we will be addressing this morning.

This Viewgragh summarizes the fiscal years 1977 and 1978 funding requirements for the principal shipboard air defense weapons program and illustrates the size and scope of the overall effort. In developing these programs we have attempted to follow two basic principles:

First, in current and projected tight fiscal environments, we cannot afford all the weapons available on all fleet units. Tradeoffs have been considered among cost, maintenance, capability, and most important, missions of the units involved. Thus, in terms of inner zone AAW defense, surface ships will receive only the systems required considering their mission. In addition, surface combatants will take on a larger measure of responsibility for protecting other units.

Second, in pursuing our programs, we must use existing technology as a base for near term improvements. That is, it would be less than prudent to rely on as yet undemonstrated "breakthroughs", however enticing they may appear. Thus, we seek a proper balance between technological feasibility for the near term and promising new areas for the future, with the overriding objective of getting better hardware into the fleet as fast as the multiple constraints will permit.

Digitized by Google

NAVY SHIPBOARD AIR DEFENSE PROGRAMS
FUNDING SUMMARY
($\overline{M}$)

	R&D		WPN		OPN		O&MN		TOTAL	
	FY 77	FY 78	FY 77	FY 78	FY 77	FY 78	FY 77	FY 78	FY 77	FY 78
AEGIS COMBAT SYSTEM	114.3	77.2					1.1	.9	115.4	78.1
TERRIER COMBAT SYSTEM	25.9	51.7	48.7	54.1	28.3	53.8	20.1	19.8	123.0	179.4
TARTAR COMBAT SYSTEM	6.3	19.5	80.1	106.6	12.0	9.1	18.4	17.9	116.8	153.1
8" BATTERY	9.8	7.6			5.5	23.6	5.7	6.4	21.0	37.6
5" BATTERY	3.1	4.7							3.1	4.7
CIWS	19.9	6.9	19.0	74.9		.8			38.9	82.6
SIRCS	2.0	3.9							2.0	3.9
ADVANCED PROGRAMS	1.0	14.5							1.0	14.5
								TOTAL	421.2	553.9

I would now like to discuss the underlying basis for the Navy Fleet air defense program—the threat. The principal air threat to U.S. naval forces is now, and will continue to be, the antiship cruise missile launched from bomber aircraft, ships and submarines.

Of the current generation of Soviet cruise missiles, the most difficult for us to counter is the [deleted]. This chart shows three estimated profiles for such a target. The slower indicated speeds are most plausible at present. These targets can be engaged by the operational Terrier and Tartar systems, or the planned Aegis system [deleted] as the targets become higher and faster, it becomes important to engage them farther out, higher, and during the turndown maneuver.

Another difficult and growing problem for fleet air defenses [deleted] in major encounters with a U.S. carrier task force, large coordinated attack are expected [deleted] such attacks place severe demands on weapon system reaction time and fire power capacity. These demands [deleted] in large part have driven the requirement for the Aegis weapon system.

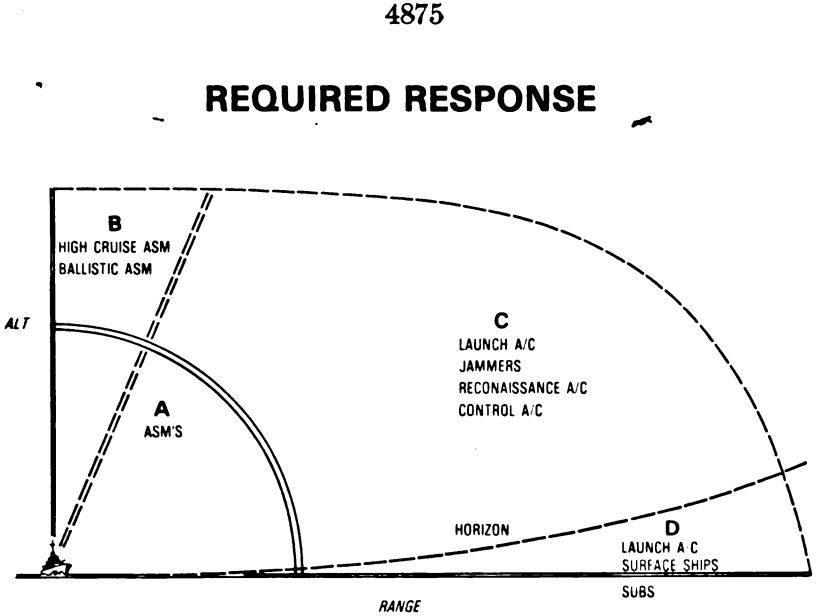
As engagement of the threat missiles increases in difficulty, the requirement to be able to engage the missile-launching aircraft and the jamming aircraft themselves grows in importance. Thus, in addition to the pressure to extend the defense to higher and faster targets, there is a need to reach to longer ranges, any significant range extension could at least force enemy launch and attack-support operations to greater standoff ranges, thus severely increasing the difficulty of attack and decreasing the likelihood of success.

I would like to illustrate the severity of the air threat to the fleet by briefly describing one possible scenario involving an attack on a two-carrier task force in the mid-1980's. This scenario was one of several developed for the Navy's antiship missile defense analytical assessment program. The enemy attack data was provided by the Naval Intelligence Command. In this scenario, which is illustrated in this viewgraph, a conventional war between NATO and the Warsaw Pact has started, and the U.S. Task Force is ordered to proceed from its Atlantic patrol area into the Norwegian Sea in connection with operations on the NATO northern flank. In transit thru the Iceland-Faroes Gap, Soviet opposition is encountered [deleted].

The purpose of this illustration is not to stress the likelihood of this particular scenario but rather to show the type of massive, coordinated air attack which the Soviets are capable of launching against naval task forces. Such an attack would be extremely difficult for our current deployed air defenses to handle.

As a further illustration of Soviet capability this viewgraph shows the operational ranges of Soviet naval aviation aircraft. The Badger and Backfire aircraft [deleted] the Bear D is a reconnaisance aircraft.

Digitized by Google



In evaluating the air threat and developing the required defenses, it is useful to portray the threat as shown in this viewgraph. The air defense envelope has been divided into four zones, each representing a different aspect of the threat. Zone A roughly represents our current area defense capability and in this zone the primary threat problem is to defeat the cruise missile itself attacking from all angles, low to high and in large numbers. Zone B reflects the problem of the very high altitude, steep diving cruise missile which poses an especially difficult problem for our sensors and weapons. Zone C addresses the engagement of the missile launch platform aircraft as well as other types of supporting aircraft. And, finally, Zone D looks to the problem of engaging launch platforms which are over the radar horizon. The threat pressures that I have summarized dictate that we move in two directions. We must improve our air defense capability in Zone A, particularly to deal with massive attacks of the type just described, and we must extend our defenses into Zones B, C and D.

The fiscal year 1978 programs which Rear Admiral Meyer will present address the required capabilities in each of these zones. These programs represent a balanced approach to fleet air defense. This approach includes modernizing the Navy's present systems to maintain their effectiveness against an evolving threat, completing the development of new systems such as Aegis and Phalanx which were designed to cope with this evolving threat and initiating concept development of new systems capable of coping with the projected threat which the fleet will face to the latter years of the next decade.

PREPARED STATEMENT OF REAR ADMIRAL MEYER

Good morning, Mr. Chairman, the threat pressures summarized by Admiral Rowden dictate extensions of AAW capability. The extensions required are different in different parts of the total engagement envelopes. The threat types characteristic of the various intercept regions are shown in the chart. Our programs address new capabilities in each of these regions.

AAW Programs

Surface ship anti-air warfare is the employment of area defense systems installed on ships which defend the area around other ships as well as themselves, and point defense systems which are designed to defend only the ship in which they are installed. The primary distinction between these two categories is range

Digitized by Google

of effectiveness. Typically for a given ship under 10 miles for point defense and 15 to 100 miles for area defense depending upon the installed systems.

The naval sea systems command fiscal year 1977 and fiscal year 1978 funding for these systems is shown in this table. Each system will be specifically addressed in the following sections of this presentation. The 8- and 5-inch battery systems, CIWS, and SIRCS will be addressed in the point defense systems category.

The three ship area defense systems are the Aegis, Terrier and Tartar combat systems.

Aegis has been under development since 1969 and is ready this year for production with subsequent installation on Navy ships.

Terrier and Tartar were introduced in the fleet commencing in the 1950's and since have been continuously improved to maintain effectiveness with the ever improving threats against our fleet.

There are a large number of AAW ships in inventory or planning, the former with Terrier and Tartar and the latter to include Aegis.

The next four charts show the AAW surface combatant populations by ship types projected into the future. The outlined area at the bottom of the charts depicts yearly totals. The last chart shows a significant population in the foreign fleets.

The engagement regions pose different performance requirements. In region B the problem is to counter the high, fast, and diving targets. In region C the problem is to reach effectively to long ranges. In region D, the basic challenge is to intercept over the horizon.

We must not cease effort in region A—the region of area defense for many years. It is here that the attack intensity pressures must be met for the increasingly fast, steep or very low targets in increasingly severe countermeasures environments.

The general defense characteristics required in the regions are shown.

Todays surface AAW response covers only region A and then only for nonsevere attacks. The region includes ranges out to [deleted] miles for Tartar and [deleted] miles for Terrier, and up to about [deleted] altitude. Area defense beyond region A is provided by carrier based fighter aircraft.

Current limitations restricting surface AAW responses to region "A" at best are show in this chart.

BASELINE COMBAT SYSTEM LIMITATIONS

SHIP

- DETECTION RANGE
- JAMMING–RADAR LIMITS & MANUAL PROCESSING
- REACTION TIME
- ENGAGEMENT

MISSILE

- KINEMATIC CAPABILITY
- GUIDANCE DEGRADED BY ECM
- ORDNANCE EFFECTIVENESS

Digitized by Google

We have been continuing our efforts to address the total ship system limitations. Improvements in our radars, including countermeasures against jamming and automatic detect and track, faster reacting launchers, and improved integration of shipboard weapons and combat control systems all will provide for greater effectiveness of our Tartar and Terrier ships against saturation and other attacks. Aegis when installed on surface ships will greatly extend this region A capability.

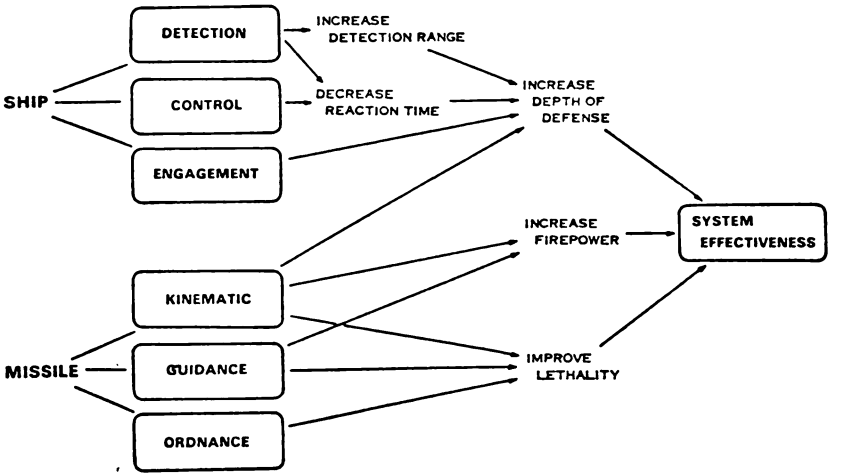
Missile improvements have likewise been developed, most notably in the now proven Standard Missile 2.

MISSILE PLANS

The foregoing improvements in ship combat systems for upgrading the detection, control, and engagement capabilities are interrelated with necessary and concurrent improvements in missile performance, as shown in this chart.

COMBAT SYSTEM UPGRADE

TECHNICAL APPROACH



Improvements in missile kinematics, guidance, and ordnance functions are necessary to improve effectiveness both within and beyond region A. Important new planning for missile extensions have been done recently, as the key to developing the system capability extensions.

Our missile programs address changes in these elements of the three missile functions which require a number of interrelated developments. Commonality of components to achieve the required missile configurations is stressed by an evolutionary program to avoid proliferation and facilitate production and long term logistic support.

The relationship of the technological developments required to improve missile performance and the desired objectives are shown on this chart.

Specific interrelationships among the developments are shown emphasizing that all are required to achieve the end goal.

The specific missile programs chosen to achieve the improvements are constrained by various engineering and resource factors. Among these constraints, the feasible missile launcher options play a key role. The chart shows the existing and potential options. The choice of launcher is influenced significantly by existing installations.

The vertical launcher would increase the allowable missile changes, but is a new development.

Further constraints affecting the choice of specific missile development programs are shown.

Digitized by Google

SORTING FACTORS

MISSILE	*SHIP*
PERFORMANCE	SHIP'S MISSION
PRODUCTION COMMONALITY	LAUNCHER COMPATIBILITY
LOGISTICS	SHIPS IN BEING
TEST EQUIPMENT	CONSTRUCTION PROGRAM
RISK	MODERNIZATION
COST	WEAPON SYSTEM IMPACT

Given the threat increase and the realistic constraints a missile program was defined after detailed study. The guidelines were: meet the threat; evolutionary approach, use experience and technology, avoid proliferation, fit existing ship systems (modified); two-phase introduction, "improved" to exploit current ships in the near term, "advanced" to provide later greater performance; match missiles to potential capabilities of ship types.

The program provides:

SM-1 MR (improved) for Tartar ships; SM-2 ER (improved) for Terrier cruisers; SM-2 MR (improved) for Aegis ships; advanced extended range (AER) missile for ships to be equipped with a new long range system; advanced medium range (AMR) missile for Aegis ships as follow-on to SM-RMI.

The payoff of the missile programs in terms of their coverage of regions A, B, C, D is shown here.

The coverage envelope is not the whole story. MRA, for example in Aegis, exploits the fast reaction, high firepower and counter measure resistance of Aegis.

The ERA Missile will require extended ship system capabilities in radars, controls, and over-the-horizon targeting.

The missile programs evolve from the present SM-1 to the currently new SM-2, and then to improved and advanced versions. These successive missile types with a high degree of commonality are in various stages of production, development, or concept formulation. The chart shows the status of each, with the applicable fiscal year 1977 and fiscal year 1978 R. & D. funding.

AAW PLAN

In summary, the surface ship AAW plan derives from the threat, which is ever changing. We have the necessary programs to update and integrate shipboard systems which, with the missile programs, are needed to provide an effective area defense.

Digitized by Google

MISSILE PROGRAM STATUS
R&D FUNDING ($M)

SYSTEM	CURRENT	IMPROVED	ADVANCED
AEGIS	SM-2 MR COMPLETING DEVELOPMENT FY77 5.9 FY78 1.1	SM-2 MRI ANALYSIS OF ALTERNATE APPROACHES	SM-2 MRA FY78 4.8
TERRIER	SM-2 ER STARTING IMPLEMENTATION IN CGs FY77 6.0 FY78 1.0	SM-2 ERI FUNDED DEVELOPMENT FY 77 5.0 FY 78 24.5	SM ERA CONCEPT FORMULATION OF APPROACHES
TARTAR	SM-1 MR IN PRODUCTION	SM-1 MRI DEFINED CONCEPT - PARTIALLY FUNDED DEVELOPMENT FY 78 6.7	–

In the area defense program as a whole, several highlights of 1976 are notable:

Aegis has now been demonstrated and tested and is now ready for production.

Standard missile 2 has been successfully tested, in both MR and ER versions, on land and at sea, against a wide variety of targets and conditions.

Automatic detect and track has been implemented in the SPS–48C radar, now in production.

Modifications of Terrier cruisers to fire standard missile 2 are underway.

An update program for Tartar DDG's has been defined and planned.

An orderly development program for vertical launchers has been established.

Missile plans have been established, as previously discussed.

Admiral MEYER. I would like to submit the Aegis KSEDS statement for the record at this point.

Mr. CROMWELL. The statement will be inserted in the record along with the accompanying charts.

[The Aegis KSEDS statement follows:]

AEGIS PROGRAM REVIEW

My presentation will cover the Aegis combat system. The fiscal year 1977 appropriation for the Aegis combat system was $115.4 million. Our fiscal year 1978 requirements are $78.1 million.

AEGIS FUNDING SUMMARY

The engineering development requirements by program element are shown here. They will be reviewed in the order shown.

Digitized by Google

AEGIS

FUNDING SUMMARY ($M)

			FY 1977	FY 1978
RDT&E			114.3	77.2
	P.E.	*PROJ. NO.*		
AEGIS	64303N	S0165-AA	26.3	27.2
CSEDS	64304N	S0325-AA	80.9	42.5
SM-2 MR	64366N	S0176-AA	5.9	1.1
ADV MED RANGE	64366N	S0924-AA	–	4.8
TASK FORCE AAW	63366N	S0324-AA	1.2	1.6
O&MN			1.1	.9
AEGIS	78017N		1.1	.9
TOTAL AEGIS			115.4	78.1

AEGIS WEAPON SYSTEM MK–7

Aegis has been a major engineering development program in the surface ship navy for the past 8 years.

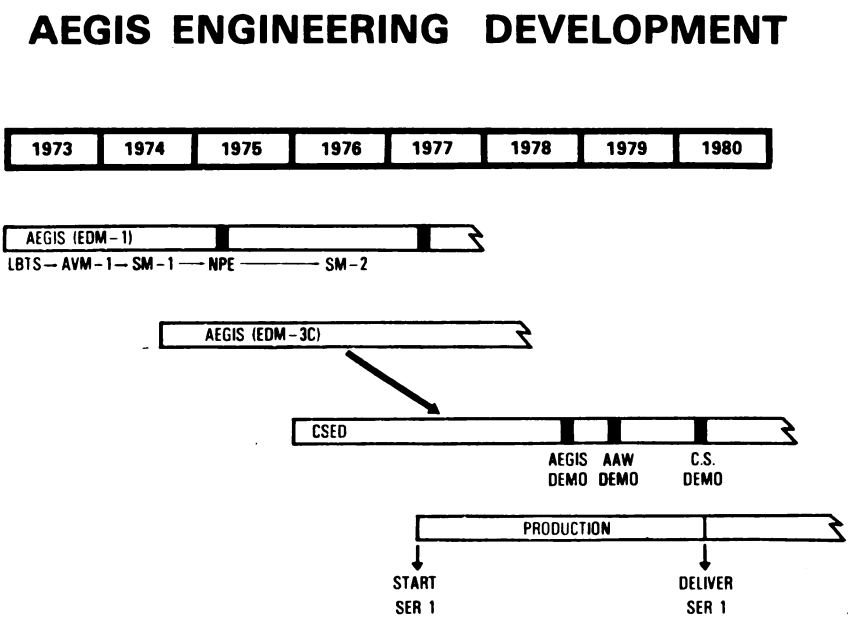
The radar system, AN/SPY–1A is the key to Aegis performance. This computer-controlled radar performs the multi-functions of search surveillance and missile guidance, while most important, it also tracks a large number of targets with fire control accuracy. The missile in the system, standard missile two, is an evolution from our current fleet ammunition, standard missile one. The MK–26 guided missile launching system handles the MR version of standard missile, ASROC ASW weapon, and can be adapted to handle Harpoon. The MK–26 is being installed in the USS *Virginia* class nuclear cruisers.

The command and decision system and the weapons control system use the standard Navy UYK–7 computers and UYA–4 display consoles. Built into the system is the online operational readiness and test system which automatically monitors system operations, detects malfunctions, and isolates faults. The fire control system is an evolution from our current Tartar system; however, in Aegis it is used for its target illuminating capability, since the AN/SPY–1A track data is used to slave the FCS direction to the target, unlike current systems where the FCS must track as well as illuminate each target.

Digitized by Google

AEGIS ENGINEERING DEVELOPMENT PROGRAM

The interdependent relationship between Aegis development, combat system engineering effort and production planning for the lead Aegis ship is shown in this chart. Concurrent with the at-sea test program, development and fabrication of the simplified Aegis elements (EDM–3C) are continuing. Upon completion of fabrication and checkout, the simplified Aegis elements will transition to the CSED site and merge with the nonsimplified Aegis elements procured under the CSED program. This simplified Aegis weapon system will be integrated and tested in the CSED program and will form the core of the Aegis ship combat system.



AEGIS 1976 ACCOMPLISHMENTS

A summary of the Aegis accomplishments for 1976 is shown here. *Norton Sound* at-sea testing continued the achievement of successful test results that culminated with the first two SM–2 (MR) at-sea missile firings. The two SM–2 firings were complete successes. The Aegis system in *Norton Sound* demonstrated a significantly high level of readings during the valiant heritage major fleet exercise. Over the 10-day period, all system availability criteria were met or exceeded.

During 1976 a number of important milestones in the development and fabrication of the simplified Aegis system were completed.

Digitized by Google

AEGIS
1976 ACCOMPLISHMENTS

- *NORTON SOUND*

  SIX SM-1 FIRINGS

  VALIANT HERITAGE MAJOR FLEET EXERCISE

  DEMONSTRATED SURFACE CAPABILITY

  FIRST TWO SM-2(MR) FLIGHTS

- *AEGIS DEVELOPMENT*

  COMPLETED AEGIS WEAPON SYSTEM PDR

  COMPLETED SIMPLIFIED AN/SPY-1A DESIGN

  COMPLETED EQUIPMENT DESIGN FCS, WCS, ORTS

SCOREBOARD 1974, 1975, 1976

(C) Overall, of the twenty-eight SM–1 firings from the Aegis system in *Norton Sound* since 1974. 21 have been completely successful. The seven failures that occurred are attributable to [deleted]. The success rate overall in the 28 firings is 75 percent.

The test conditions associated with these firings have been progressively more difficult. Flights have emphasized low altitude engagements, crossing engagements, surface targets, supersonic targets, ECM environments, and maneuvering targets.

In addition to firing SM–1 missiles, *Norton Sound* has commenced at-sea SM–2 missile firing evaluations. The first two firings, we stated previously, were complete successes in all phases of the test effort.

Digitized by Google

AEGIS SM-1 FIRING SCOREBOARD
1974 - 1975 - 1976

1974	11 FIRINGS -	6 SUCCESSES
1975	11 FIRINGS -	11 SUCCESSES
1976	6 FIRINGS -	4 SUCCESSES
TOTAL	28 FIRINGS -	21 SUCCESSES (75%)

14 CONSECUTIVE SUCCESSES OCT 1974 - FEB 1976

AEGIS FISCAL YEAR 1977 OBJECTIVES

Our fiscal year 1977 objectives include a most strenuous Aegis/SM-1 at-sea missile firing test program set forth by CNO project 124/265. A number of these firings will be made under the direction of Optevfor, the Navy's independent test evaluator.

With the completion of the SM-2 missile firings, proofing of the Aegis weapon system will complete and the system will be ready for production release.

Testing of significant components of the simplified Aegis weapon system will be conducted during 1977. The computer program design will be completed along with a number of critical weapon system reviews.

Digitized by Google

AEGIS
FY 77 OBJECTIVES

NORTON SOUND

- D AEGIS/SM-2 FIRINGS (CNO PROJECT 124/265)

RELEASE FOR PRODUCTION

AEGIS DEVELOPMENT

- TEST AN/SPY-1A ARRAY & SIGNAL PROCESSOR
- COMPLETE AEGIS C/P DESIGN
- CONDUCT AEGIS WEAPON SYSTEM CDR

AEGIS FISCAL YEAR 1978 PLANS

Fiscal year 1978 plans are summarized on this chart. At-sea evaluation of the Aegis system in *Norton Sound* will continue until August 1978 when the ship will commence its ROH.

The simplified Aegis effort will concentrate on AN/SPY-1A element tests, leading to the Aegis demonstration (OT-IIIB), the first system tests at the combat system engineering development site at Moorestown, New Jersey.

Digitized by Google

AEGIS
FY 78 PLANS

- *NORTON SOUND*

  CONTINUE ENGINEERING EVALUATION

  COMMENCE ROH AUG 78

- *AEGIS DEVELOPMENT*

  CONDUCT AN/SPY-1A ELEMENT TESTS

  COMMENCE AEGIS INTEGRATION OT IIIB

  PERSONNEL WORK UP FOR OT IIIB

AEGIS R.D.T. & E., N. FUNDING

The functional tasks by activities are reflected here. At-sea testing of the Aegis system in *Norton Sound* will continue, but at lower levels than fiscal year 1977, while more resources and effort are applied to the simplified Aegis system. Efforts in computer program development/integration and test and evaluation will increase.

Digitized by Google

AEGIS
RDT&E, N FUNDING
($M)

PE 64303N

TASK	ACTIVITIES	FY 77	FY 78
EDM (AT-SEA)	RCA - MOORESTOWN, N.J. NSWSES/PMTC FLTAC APL	8.6	5.8
DESIGN SIMPLIFICATION/TESTING	RCA/APL	7.7	7.5
COMPUTER PROGRAMS DEV/INTEG	RCA/APL/SCI/NSWC-DAHL	1.9	3.9
ILS/DATA/CONFIG. MGMT	RCA/NSWSES/VITRO/BIRD	2.2	2.1
AEGIS/SM-2 INTEGRATION	GENERAL DYNAMICS - POMONA, CA. RCA/FLTAC/VITRO	1.8	1.5
SYSTEM TEST & EVALUATION	RCA/NSWSES/APL/FLTAC	.8	4.5
ENGINEERING/PROGRAM MGMT	RCA/NSWSES/APL/NAVSEC	4.3	1.9
	TOTAL	26.3	27.2

CSED PROGRAM

I will now update you on the status of the combat system engineering development program that commenced in fiscal year 1976.

AEGIS COMBAT SYSTEM CSED SITE

The CSED program is the next evolution in the engineering process leading to fleet introduction of multi-mission Aegis ship combat systems with minimum technical, schedule and cost risks. This chart shows the Aegis combat system which will be validated at the CSED site, at Moorestown, New Jersey—in close proximity to the Aegis prime contractor, RCA.

The Aegis weapon system is the "core" of the combat system, to this "core" we add and closely integrate the other AAW ssytems—that is: communications, data links, sensors, and the close-in weapon systems. Finally, since surface and submerged threats can almost instantly turn into AAW threats, direction of surface and subsurface systems is closely coupled into the system.

Simulators will be used in place of actual components for those item which cannot be economically tested at the land based site.

CSED PROGRAM PLAN

This is the CSED plan: in the initial phase of the CSED program the Aegis equipment and computer programs which are at the heart of combat system will be built, installed, and tested at the site. The effort will be directed toward the evolution of the Aegis EDM-1 in norton sound into "simplified Aegis."

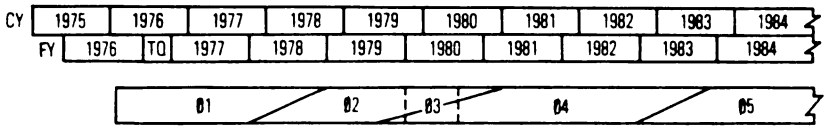
During phase two the other elements of the combat system will be installed and integrated into the combat system at the CSED site.

During Phase 3 we will accomplish an I.O.T. & E. demonstration to demonstrate successful integration of the Aegis combat system.

Historically new combat systems have required isgnificant reprogramming on fleet introduction to affect compatibility and interoperability with other tactical units. Consequently, during Phase 4 we will commence the shift from development to inservice suppotr of Aegis ships. As part of this effort, computer programs maintenance and configuration management of the combat system will be initiated at the Naval Surface Weapons Center, Dahlgren, Virginia.

Digitized by Google

CSED PROGRAM PLAN



- PHASE 1 -- COMBAT SYSTEM DESIGN AND AEGIS SYSTEM INTEGRATION

  NOW - 1978

- PHASE 2 -- COMBAT SYSTEM INTEGRATION AND TEST

  1977 - 1980

- PHASE 3 -- INITIAL OPERATION TEST AND EVALUATION

  1980

- PHASE 4 -- ESTABLISH SITE FOR LIFE SUPPORT OF AEGIS SHIPS

  1979 - 1983

- PHASE 5 -- FLEET SUPPORT

  1983 — 2000+

CSED 1976 ACHIEVEMENTS

In early 1976 the CSED program commenced under an level of effort contract with RCA, Moorestown, N.J., We selected NSWC/Dahlgren as the life support engineering agent and secured the USAF space tracking facility at Moorestown, N.J. as the initial CSED site.

Necessary long lead procurements for the CSED facility were initiated.

A cost plus award fee contract was executed with RCA in September, and RCA in turn executed the necessary site modification contract.

CSED

1976 ACHIEVEMENTS

FEB 76	CSED PROGRAM BEGUN UNDER LOE
MAR 76	NSWC/DAHLGREN SITE SELECTED
MAY 76	USAF SPACE BALL TRANSFERRED
JUN 76	LONG LEAD MATERIAL PROCUREMENT
SEP 76	CSED CONTRACT SIGNED
DEC 76	SITE MODIFICATION CONTRACT AWARDED

Digitized by Google

CSED FISCAL YEAR 1977 OBJECTIVES

The major fiscal year 1977 activities for the CSED program are shown in this chart. The CSED site will be commissioned in May of this year. Equipment installation will commence, combat system engineering and design will continue. system interface will be validated and Navy personnel training and build up will continue.

CSED

FY 77 OBJECTIVES

- **COMMISSION SITE MAY 77**
- **CONTINUE COMBAT SYSTEM ENGINEERING AND DESIGN**
- **CONTINUE COMPUTER PROGRAM DESIGN AND TEST**
- **COMPLETE EQUIPMENT AND COMPONENTS PROCUREMENT**
- **VALIDATE SYSTEM INTERFACES**
- **CONTINUE NAVY PERSONNEL BUILD-UP**

CSED SITE

Shown here is an artist's concept of how the CSED facility will look with an Aegis ship superstructure section in which the major part of the above decks Aegis equipment will be installed.

CSED PROGRAM

These are the major milestones of the CSED program. We are on schedule and costs are within our budgets.

CSED FISCAL YEAR 1978 PLANS

The CSED plans for fiscal year 1978 include a number of significant events. Thee Aegis combat system will be critically reviewed to assure that we have the best and most cost effective design. The initial builds of the combat system computer programs will be completed.

In the hardware area, we will complete the An/Spy-1A radar and Aegis fire control system element tests.

The above effort will culminate in the validation of the Aegis weapon system demonstration in October 1978.

Digitized by Google

CSED
FY 78 PLANS

NOV 77	AEGIS SHIP COMBAT SYSTEM CRITICAL DESIGN REVIEW (CDR)
JAN 78	COMPLETE INITIAL BUILDS OF COMBAT SYSTEM COMPUTER PROGRAMS
JUL 78	COMPLETE AN/SPY-1A ELEMENT TESTS
JUL 78	COMPLETE AEGIS FCS ELEMENT TESTS
SEP 78	AEGIS WEAPON SYSTEM DEMONSTRATION (OT IIIB)

CSED FUNDING

$80.9 million was allocated to carry out the fiscal year 1977 portion of the CSED program. System engineering and design of the total AEGIS Ship Combat System and associated computer programs continued as well as purchase of necessary long-lead equipment and components. The contract for modification of the CSED site was awarded in December and site commissioning is scheduled for May of this year. Preliminary design review (PDR) of the combat system will be completed this fiscal year. Increased Naval Surface Weapons Center (NSWC) participation in the Aegis program commenced in fiscal year 1977 to provide NSWC with the technical knowledge necessary for assumption of responsibility fore life support of the Aegis combat system.

Fiscal year 1978 funding of $42.5m will provide resources to conduct the critical design review (CDR) of the Aegis ship combat system and to complete AN/SPY–1A Radar element tests. Initial builds of the combat system computers programs will be completed. Preparation for the Aegis weapon system performance demonstration, scheduled for October 1978, will continue.

Finally, as the CSED program achieves full maturity, fleet support, consisting of configuration management, computer program maintenance and in-service engineering will be provided for Aegis ships.

Digitized by Google

CSED
RDT & E, N. FUNDING

PE 64304N ($M)

TASK	ACTIVITIES	FY 77	FY 78
PROG/PROJ MGMT	RCA/APL/VITRO/SCI/NSWSES	3.5	.6
SYSTEM ENGINEERING	RCA/NSWSES/APL/VITRO/SCI	6.3	2.5
AEGIS EQPT PROD/INTEG	RCA	24.4	6.4
COMPUTER PROGRAM DEVELOPMENT	RCA/SCI/FCDSSA/NAVSEC	16.3	13.1
GOVERNMENT FURNISHED EQPT	UNIVAC/RAYTHEON/ HUGHES/LOCKHEED/LITTON	17.0	3.2
SYSTEM TEST & EVALUATION	RCA/APL/NAVSEC/ NSWSES/FLTAC	8.7	6.9
ILS	RCA/VITRO/NSWSES/BIRD	4.7	2.6
LEAD LAB DEVELOPMENT	NSWC/DL	(3.8)	7.2
	TOTAL	80.9	42.5

STATUS OF AEGIS SHIP PROGRAM

Mr. CROMWELL. We will start into the Aegis program, Admiral Meyer, the Aegis has been reviewed by the subcommittee for the last 5 years and has gone through quite a transition. For the first 3 years the basic question or challenge seemed to be, why do we need the Aegis capability and is it worth the cost?

For the last 2 years the basic issue has changed to, why would any new ship be built without the Aegis capability?

Yet we are still awaiting approval of the first Aegis ship, which is now requested in the fiscal year 1978 budget as full funding for $930 million for the lead DDG–47.

Would you review for us, in order to build up a record here, what the Aegis ship proposals have been over the last several years; and also would you give us in detail the plans, starting with the fiscal year 1977 budget submission to Congress and tracing it on through as it changed, until we now are in the fiscal year 1978 amended budget?

Admiral MEYER. Well, I believe that question could more properly be answered by Admiral Doyle.

Admiral DOYLE. As you know, last year in the shipbuilding program we had at the outset in the original submission a DDG–47, which is the 963 with Aegis, full funded in fiscal year 1977, and also long-lead funding for a strike cruiser which was also Aegis equipped.

During the course of the hearings and debate and discussions on the shipbuilding bill, and in markup, particularly in the House, on the House side, the DDG–47 was deleted from their markup, and instead the conversion of the USS *Long Beach* to Aegis was inserted.

Digitized by Google

The rationale behind this was primarily that Aegis should go on nuclear-powered ships because they were going to be operating with the strike forces.

The Navy had taken the position—and still takes the position—that Aegis should go on both conventional ships and nuclear-powered ships, because we have a need for surface combatants with Aegis, to operate with nuclear-powered task forces, all nuclear-powered task forces, and also conventional ships—namely, the DDG–47—to operate with the conventional carrier task force, and in addition to operate with amphibious forces with replenishment groups in high threat areas.

Then, what happened after that was in the conference between the Senate and the House, the Senate had taken the position that the DDG–47 should stay but the strike cruiser should be eliminated.

Well, the upshot of all that was to delete both the DDG–47 full funding for that and the long lead funding for the strike cruiser, and leave in the *Long Beach* conversion.

In later testimony in June before the House Appropriations Committee, the Navy made the point that our priorities as far as Aegis ships were, first, the DDG–47, because that could be full funded in the year you requested it and you wouldn't require long lead funding; second, the nuclear-powered ship; and, thirdly, the *Long Beach* conversion; and that was our priority.

When both the DDG–47 and the strike cruiser fell out, we then supported, on the basis of the necessity to at least get Aegis to sea on one platform, we supported the *Long Beach*. These programs were reviewed in connection with the submission of the 1978 budget and President Ford decided at that time that we would not convert the *Long Beach* to an Aegis ship but instead would, in the 1978 budget, submit a request for full funding for the DDG–47 in 1978 and long lead funding for the strike carrier in 1978.

Subsequently, President Carter reviewed the shipbuilding program and decided that—he reaffirmed the decision not to convert the *Long Beach*, and, in addition, deleted the long lead funding for the strike cruiser and, in effect, said that he was going to be reviewing the program for nuclear-powered Aegis ships.

So I think that brings up to the present situation, the only Aegis ship that is in the budget is the DDG–47.

Does that answer the question?

Mr. CROMWELL. Yes, that is a thorough summary.

Just to complete it, what has happened to the funding that was approved last year for the conversion of the *Long Beach?*

Admiral DOYLE. That was the subject of a rescission, and I don't think the vote is finally complete in the Senate, but the House voted, I believe, in favor of the rescission.

Mr. CROMWELL. So then we do end up, as you summarized, with the only Aegis program right now being the request for fiscal year 1978, to go ahead with one DDG–47?

Admiral DOYLE. DDG–47. As the Secretary of the Navy testified the other day before the Senate Armed Services Committee, the Navy is looking at various alternatives to get Aegis to sea on a nuclear-powered cruiser, and is examining various alternatives right now.

Mr. CROMWELL. Thank you.

Digitized by Google

R. & D. COSTS OF AEGIS

Admiral Meyer, how much has been invested to date in Aegis R. & D.?

Admiral MEYER. Approximately $500 million.

Mr. CROMWELL. Does that include the CSEDS?

Admiral MEYER. No, it doesn't.

Mr. CROMWELL. That adds another $50 million?

Admiral MEYER. Yes, it does.

RELATIONSHIP OF R. & D. TO AEGIS SHIP

Mr. CROMWELL. Is the fiscal year 1978 R. & D. request for Aegis of $77.2 million related to the DDG–47 ship, or is the development working this year independent of the ship platform?

Admiral MEYER. The money that is listed in that particular line is substantially independent of the ship platform; that is to say, the CIC design presently will fit or apply to whatever Aegis platform is approved. That $77 million consists of $27.2 million in the Aegis line, $42.5 million in the CSEDS line, and the remainder in the missile line, but the money can be and will apply across the board, I believe, to any version I have heard discussed for the Aegis ship.

Mr. CROMWELL. At what point in time does the development program become ship platform related?

Admiral MEYER. Well, I would say 10 to 12 months from now; we are in that situation. It will be hard to proceed much further in another 12 months if we can't get a definitive answer to the ship plans.

Mr. CROMWELL. Does that imply that it is in the start of fiscal year 1979?

Admiral MEYER. In a sense, and maybe I ought to clarify that a little bit, because I don't mean to imply that all the money will be wasted if we don't have a definitive ship platform, but the development will be far enough along that the expenditures, of say, the final one-third of the CSEDS effort moneys needs to be oriented and focused on the final product. We would really be sliding backwards in about 12 months if we don't get some answers.

Mr. CROMWELL. If we approved the fiscal year 1978 R. & D. request can we support it as being required independent of the ship?

Admiral MEYER. I believe that would be correct, that the 1978 money could be independent of the ship, yes, sir.

Mr. CROMWELL. You are the program manager; your testimony is that you believe it to be correct? Do you know or not?

Admiral MEYER. Yes, sir; I would say it is.

TECHNICAL STATUS OF AEGIS

Mr. CROMWELL. Would you give us a summary of your technical status in the development program?

Admiral MEYER. Yes, sir. I can give that to you now or put that in the record, as you prefer.

Mr. CROMWELL. Give us a short summary and amplify it as you wish for the record.

Digitized by Google

Admiral MEYER. All right. The year mostly has been devoted to three approaches. One has been related to the testing inour ordnance test ship, U.S.S. *Norton Sound*—the second has been related to the final stages of the simplification engineering, which we talked to you about in previous years.

Thirdly, as mentioned earlier by you, the combat system engineering development line itself is proceeding.

In *Norton Sound* we fired six standard missile 1's this year. We participated for a 10-day period in a fleet exercise called Valiant Heritage, a very, very successful exercise off the California coast, wherein *Norton Sound* operated with the aircraft carrier *Enterprise.*

It should be noted that in that particular exercise the jamming levels and the airplanes flown against what would be classed as a major exercise, *Norton Sound* was credited with [deleted] percent success both in her detection capability of these aircraft under jamming conditions and also in her engagement capability.

Since that time we have commenced the Standard Missile 2 firings; last December we fired the first Standard Missile 2 of a planned [deleted] missile series in*Norton Sound.* That was against a subsonic target at a nominal range of [deleted] miles; and it was a direct hit; that is to say, the missile physically collided with the target.

In February we fired the second in the series. This was against a supersonic target that had approximately the same range, and the missile came well within the lethal range; so we feel that the basic demonstration of Standard Missile 2 operations has been accomplished now in *Norton Sound*, even though we have a number of other firings that we intend to do in the coming months.

We have been plagued with propulsion difficulties in *Norton Sound* since last summer, and she has been in the shipyard on several occasions. That has impaired our test schedule a good deal.

In the simplification engineering work, that has been going on primarily at RCA, Moorestown, N. J., with materials flowing in from our various vendors, the new array is in final assembly, and in a few days will move to its intermediate test site. To give you a feel for the progress made there, the array in Norton Sound weighs 17,000 pounds. The new array will weigh 12,000 pounds. We haven't given up any performance in the array to get the weight reduction.

Of course, in the design such a weight reduction is extremely important to us, because the arrays are topside, and 5,000 pounds out of each array, with four to be installed in each ship, is a significant weight reduction topside.

The new signal processor is in its final stages of checkout in its test site. The tests are going delightfully well, both in the time and the time it takes for them and in the results.

The Program Generation Center is now fully equipped in the Computer Science Building at Moorestown and is ready to proceed with the generation of the programs to support the Aegis combat system.

We have had a few products come out from it so far.

To give you an example here, a particular product associated with the radar, which we refer to as a "build," a couple of weeks ago went through its acceptance. It took us about 7 days for the acceptance

Digitized by Google

test for that particular build when it went to Norton Sound; but it only took us 3 hours to do the acceptance test on it for the new model, so we feel that to be substantial progress.

The combat systems engineering site itself will be erected in what was formerly the U.S. Air Force space track facility at Moorestown located near the plant. Navy assumed custody of it during the past year. We now have an officer in charge there.

We have several enlisted who have reported. Our crews are forming up. The contract for the architectural and engineering work and the modification work under the direction of RCA was let this previous December. We expect to formally commission the site the latter part of May this year and equipments will start moving into it in anticipation of coming together for the systems integration of the shipboard combat system itself.

Mr. CROMWELL. Do you have any outstanding technical deficiencies or technical problems that you are working on at tihs point in time, things that are red flags to you as a program manager, as opposed to the normal kind of development tasks?

Admiral MEYER. Yes, sir; there are a few, certainly yellow flags around, if not red. In a computer program development of this size one has to constantly fight the timing in the design, and we have had to wrestle a couple of times this year in being able to cope with the timing demand in the command and control system. We believe we have that under control by the introduction of other processors in the system and don't foresee any difficulties with it.

Earlier in the year we had an [deleted].

We have learned to live with that. We have found that we are not [deleted] but we are still not satisfied with the [deleted] from a tactical viewpoint, and we have some modest funds this year and next year in the Standard Missile 2 line in order to do some redesign work, to get those [deleted] up for tactical operations.

There is a constant concern on my part on the ability to maintain the system. It is, of course, a very complex system and it encompasses a great deal of capability. I believe this is under control.

The tests that we have done in the simplification engineering all would indicate so. The simulations that we are running associated with it would indicate it is under control so I would say on balance that we don't have any serious red flags, unless—I say this maybe for Admiral Doyle's benefit—unless it is one of morale. We want to get on with it.

Mr. CROMWELL. Are you meeting your maintenance specifications?

Admiral MEYER. Yes, sir; we are. We are meeting those and I think that in the eyes of the law they are satisfactory, but they are not satisfactory from my viewpoint. I would like to see them a lot better, would like to see more margin in it.

AEGIS COSTS

Mr. CROMWELL. What is the total development cost estimated for the Aegis? That would include the CSEDs and also what is the per ship procurement cost as now estimated?

Digitized by Google

Admiral MEYER. All right, I would give you the precise number on the first half of this question, but I believe that it would approach about $800 million—if I had a chance to add these numbers up.

The first ship, as she is in the budget now, is $930 million, associated with the DDG–47.

Mr. CROMWELL. What is the Aegis part of it?

Admiral MEYER. Excuse me. The combat system itself, is approximately $350 million.

Mr. CROMWELL. What is the recurring or the follow-ship cost for the combat system? If you don't haveit, will you provide it?

Admiral MEYER. Yes; I do have it. Here is the production estimate for Aegis DDG–47's. The cost in fiscal year 1978 dollars, the lead ship, $279.5 million; the follow ship, $152.3 million, that is, associated with the weapon system itself.

Admiral DOYLE. But just the Aegis, not the rest of the combat system?

Admiral MEYER. It does not include the rest of the combat system or ordnance.

Mr. CROMWELL. Would that be comparable to the $115 million figure we had about 2 or 3 years ago?

Admiral MEYER. Yes, sir; it would be, and I think that if the $115 million is escalated, it will match pretty well what we said to you then.

Mr. CROMWELL. All right. Thank you.

SOVIET VIEW OF CARRIER VULNERABILITY

Mr. OLD. Admiral Doyle, you said in your preliminary statement, but not in the statement that is here today, that the Soviet perception regarding the vulnerability of our carriers needs to be reversed. What would be the basis of that perception?

Admiral DOYLE. Well, I looked over that statement the other day and told them to take that out, because that is a little too fuzzy at this stage of the game. That is the reason it isn't in my statement.

Mr. OLD. Do you have, or does someone on your staff have some perception that the Soviets view our fleet assets as being vulnerable?

Admiral DOYLE. Let me state it another way. If you look at the emphasis that the Soviets have placed on coordinated cruise missile attacks around the clock, and if you look at the writings of Gorshkov in his latest book on sea power, they consider that they have got to go after our high value units, particularly the carrier task forces, with those kinds of attacks to knock them out so that we can't do our job.

I don't know how they perceive it. There is no question it is going to be—if we get to that point—it is going to be a tough battle. That is the way I sort of state that issue, without getting into the business of what their perceptions are, because I don't know what their perceptions are.

All I know is that the threat is very real and they are putting a lot of emphasis on it.

Mr. OLD. Isn't that sort of the basis for the whole Navy air defense program?

Admiral DOYLE. Absolutely, but the reason I took it out, I just didn't want to focus in on the carriers as opposed to any other group,

Digitized by Google

any other task force, whether it be amphibious task forces or underway replenishment groups. It is a real threat that all of those forces have to operate in, and that was why we have to improve our fleet air.

Is that responsive to your question?

Mr. OLD. Yes; I believe it is, although I am not sure that I see too much wrong with the statement. I suspect they do perceive that carriers are fairly vulnerable in the air defense business and it would be kind of obvious if they came and read the annual testimony that is totally available to them.

We gladly hand out a copy when the man from the Soviet Embassy walks in. We know who he is and give it to him; so they read this probably closer than we do.

Admiral DOYLE. I just didn't want to pinpoint any particular task force, that is all.

Mr. OLD. Admiral Rowden, I noticed you revised your statement somewhat, too.

Admiral ROWDEN. Yes, sir.

OPERATIONAL READINESS OF SM-1

Mr. OLD. For the past 2 years the committee has questioned Navy about the operational readiness rate of the SM-1. Would you inform the committee, the subcommittee, of what that rate is today?

Admiral MEYER. Yes, sir, we can, and I thought that since it comes up each year, I have Captain Hatch with me.

Mr. OLD. If you wish to have the captain do it, I think, for the record, it will be fine.

Admiral MEYER. Thank you.

[The information follows:]

Captain HATCH. The operational readiness rate of SM-1 today is as follows:

	March 1977 readiness
SM-1 (MR)	[Deleted]
SM-1 (ER)	[Deleted]

AEGIS ON USS LONG BEACH

Mr. OLD. For a number of years the House Armed Services Committee has wanted to add the Aegis system to the *Long Beach*. Does the Navy continue to support that proposal?

Admiral DOYLE. Not at this time. We are supporting the administration's position, which is not to convert the *Long Beach*. The decision was made by the last administration and reaffirmed by this administration.

Mr. OLD. Did the Navy ever propose that the *Long Beach* be converted to the Aegis system?

Admiral DOYLE. During the process last year of the debate on the shipbuilding program, first of all, it was not in the original budget last year; it was not in simply because the priority was for new ships and there simply wasn't money within the fiscal constraints to work in the *Long Beach* conversion.

Digitized by Google

We did support later in the year, after both the 47 and the strike cruiser fell out, we did support conversion of the *Long Beach* as the fastest way to get Aegis to sea. However, as I indicated, both administrations have chosen not to convert the *Long Beach*, and that is where we are right now.

VULNERABILITY OF AEGIS TO BATTLE DAMAGE

Mr. OLD. The House Armed Services Committee has been critical of the vulnerability of the Aegis system because many components were topside. Regarding vulnerability, how does Aegis compare to other Navy systems, and will this House criticism be appropriate to the DDG–47?

Admiral DOYLE. I believe that the Aegis system is less vulnerable than existing systems because, for example, in the phased array radar you can sustain some damage and still retain a capability, whereas in the rotating radars that we have, you can't do that. So I think that it is more survivable than existing systems and certainly it provides a much greater capability.

The 47 is a destroyer hull. We were working with the 963 *Spruance*-class ship. We could not do all the things we would have liked to have done in improving its survivability; but we did make some significant improvements over that in the 963.

As a result, we are going to have the most survivable destroyer that we have put to sea.

Mr. OLD. Thank you.

TASK FORCE AAW PROJECT

Mr. CROMWELL. What is the current status of the task force AAW program, Admiral Meyer?

Admiral MEYER. The task force AAW program this year in fiscal 1977 has a little over $1 million in it. We have been engaged in dialog with the D.D.R. & E. in coming to a common and acceptable understanding on how to spend that money; so, in fact, the money today is held by the D.D.R. & E. pending resolution with them and these officers sitting here at the table on how to proceed into the next step.

In 1978 we have $1.4 million, as I recall, to continue that effort.

We expect to have a resolution of it within the next few weeks.

Mr. CROMWELL. How will a development contractor be selected, and what type of system is envisioned?

Admiral MEYER. Working backward on it, our studies show right now that we require significant computational capacity in the Aegis ship to do the necessary coordination functions with the rest of the force.

Now, how much is to be done there is a tradeoff between the ultimate objective desired and the costs that you can afford to devote to it.

It is my judgment as the program manager that this work should be done through the Aegis prime contractor because it calls for a sig-

Digitized by Google

nificant and intimate knowledge of the Aegis data design itself in order to be able to do this effort.

We just don't yet know what the design of the computer facilities will be; we aren't prepared to answer that yet.

Admiral DOYLE. I just wanted to add, if I might, the whole business of task force/AAW coordination, what I think you are talking about, is the ability of the Aegis system to actually designate and control the other missile systems within the formation, as opposed to the present system where we would use the naval Tactical Data System to relay such information. The task force AAW coordinator program would take advantage of the extra capability you get from the SPY I radar both in the clear and jamming environments, and then relay that information to the other missile ships. They, in turn, would have a better idea of what targets to go after, and so on and so forth.

That is the way we do it right now; and, of course, the addition of Aegis ship into the formation will enhance that task force AAW capability.

The ultimate, of course, would be to get to the point where you are doing this automatically, and there is a lot of technical work to be done, data handling, management work to be done in that area.

Mr. CROMWELL. Do you believe that the material presented to the committee today justifies the fiscal year 1978 request for $1.6 million?

Admiral MEYER. Yes; I do. We have said that such coordination is possible and the potential is now available in the Aegis ship design. We have been toldby the Department of Defense, even in essence by the Congress, to get on with such an effort, and we must have some money to do it with; and I think that that amount of money is justified, yes, sir.

Admiral DOYLE. I think it is extremely important to get on with this job. I think we can realize a much greater capability than just doing it with the NTDS system.

[The prepared statement of Admiral Meyer follows]

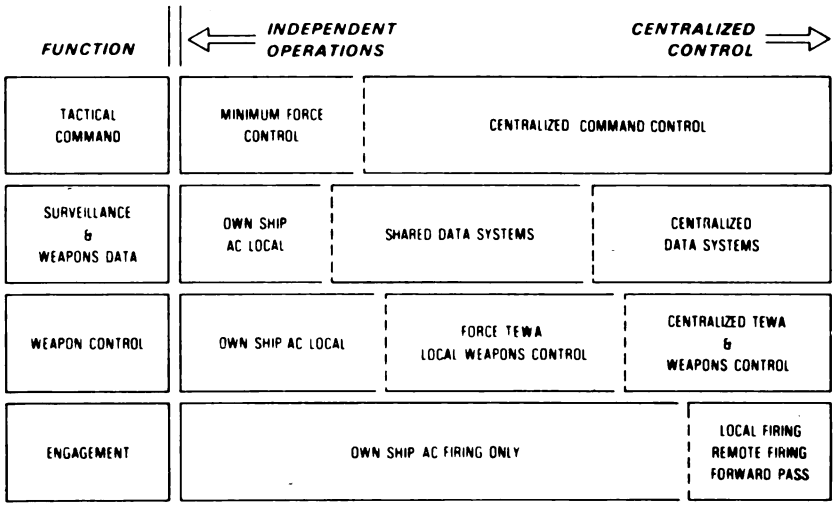
TASK FORCE AAW

AAW COORDINATION OPTIONS SPECTRUM

Task force antiair warfare coordination is a step forward in increasing fleet effectiveness through more effective coordination fleet surveillance, tactical command, force weapons and engagement systems. The spectrum of options vary from independent ship operations to completed centralized data systems and cooperative area of other units weapons. The introduction of Aegis into the fleet, with its improved surveillance and control capability, will provide the opportunity for great improvement and efficiency of coordination. The task force, antiair warfare program addresses this potential capability.

Digitized by Google

AAW
COORDINATION OPTIONS SPECTRUM



TFAAW FISCAL YEAR PLANS

Our fiscal year 1977 plans will complete studies defining the requirements needed to provide improved force coordination. A technical approach will be outlined which will assess current and future capabilities. Finally a system definition will be drafted which will consider applicability of current equipments and systems as well as requirements for new developments.

TFAAW
FY 77 PLANS

- COMPLETE REQUIREMENTS DEFINITION
- OUTLINE TECHNICAL APPROACH
- DRAFT SYSTEM DEFINITION

TFAAW FISCAL YEAR OBJECTIVE

During fiscal year 1978 we will initiate development of an improved force coordination system.

Digitized by Google

TFAAW
FY 78 OBJECTIVE

INITIATE DEVELOPMENT

Mr. CROMWELL. Senator Hart has some questions for the record on the Aegis. Without objection, they will be inserted at this point in the hearing record.

QUESTIONS SUBMITTED BY SENATOR GARY HART

[Questions submitted by Senator Gary Hart, answers supplied by Admiral Meyer:]

Senator HART. Is the Aegis system designed for growth capability? How?

Admiral MEYER. The Aegis system is a technologically advanced system. The fundamental characteristics were determined to meet future threats; particular emphasis has been given to radar performance and reaction time. A large advance in these respects was attempted and achieved. The increment provided by the Aegis radar and the automation are basic to meeting any new challenge that may evolve.

There are four options an enemy may emphasize in attempting to defeat or penetrate a defensive system:

(1) Decreasing the probability that the attacker can be detected.

(2) Limiting the time available for defensive action.

(3) Decreasing the probability of successful intercept.

(4) Saturating the defenses.

Soviet developments and tactics are rapidly overtaking current surface-to-air capabilities and they have exercised all of the options to varying degrees. Our current systems permit this flexibility to the enemy because high payoffs are available in each option. This will no longer be true with the introduction of Aegis. There are no easy ways open to him to decrease probability of detection. to effectively limit the time available for defensive action or to saturate our defenses. His available options for high pay-off developments are thus limited to the terminal phase of the intercept. Our efforts can also now be concentrated on ensuring a successful terminal intercept and kill. A program for higher performance missiles which look toward such threat developments has already been outlined.

Digitized by Google

The Aegis system design permits future modifications in response to changing threats. The key features of the design that provide the basis for this capability are: (1) the flexibility of phased array radar; (2) the use of digital control; and (3) the basic channelized approach to the functional design of the system.

The multifunction, digitally controlled, phased array radar, the primary source of target data for the system, provides a solid basis for the future in the areas of electronic counter-countermeasures and the ability to cope with a wide variety of threat vehicles attacking from any point in the hemisphere. Digital control permits this adaptation. This is accomplished in most cases via computer program modification rather than equipment modifications. "Channelization" in Aegis means that wherever possible important multiple and identical functions are accomplished via parallel independent paths. "Channelized" elements are semi-independent in function and can be rearranged to achieve modified system configurations or replaced to accommodate system growth. The channelized approach taken in the system design results in the capability to tolerate large changes and alterations to the channelized elements to cope with changes in the threat.

Specific examples of growth capability designed into Aegis can be cited:

(1) Capability to handle a missile with greater dynamics and intercept range than the SM–2. The system can (with minor modifications to the computer programs) successfully operate with missiles with twice the speed and range of the SM–2. The missile launching system can accommodate missiles 22 inches longer, 1 inch larger in diameter, and over 40 percent heavier than the SM–2 MR). A missile with greater dynamics could greatly increase the threat spectrum with which the Aegis could effectively counter.

(2) Both the Aegis system and the SM–2 missile have the control features required to incorporate nuclear warheads.

(3) The Weapon System design permits the later introduction of a vertical launching system.

Senator HART. To what degree is Aegis a modular system?

Admiral MEYER. The basis for Aegis design from the "ground up" has been channelization and modularity. Such an approach:

(1) Increases applicability of the basic design across a broad range of ship classes.

(2) Increases system availability by reducing reliability choke points.

(3) Decreases system vulnerability to battle damage.

(4) Provides potential for system change during its service life by modular replacement of system elements.

The modularity of the Aegis is best evidenced in the areas of the fire control illuminators, guided missile launchers and missiles. Both the equipment and the computer programs that operate these elements are designed in such a manner that the system can be configured with 2, 3, or 4 fire control illumination channels or 1 or 2 guided missile launching systems. The launching systems can contain 24 missiles, 44 missiles or 64 missiles, giving a total missile load out range of 24 to 128.

Configurations employing any combination of these elements can be obtained by selection of appropriate combinations of interface equipments and by insertion of appropriate adaption data into the tactical computer programs.

The modular design permits adaptations of the system for different ships. The system can fully and efficiently exploit the unique capabilities of various ship classes.

The concept of modularity has also been carried down into the design of the individual elements of the Aegis System such as the AN/SPY–1 radar. Here accommodations are made for the future modular replacement of the phased array should one of lower cost or lighter weight be developed, without redesign or significant impact on the remainder of the system. Accommodations are also provided for future product improvement via modular replacement in the radar transmitter area.

Senator HART. Has the capability of Aegis been reduced in any way since the system was originally conceived? If so, in what ways?

Admiral MEYER. On the contrary, the capability has increased. This was necessitated by the overly long period of development accompanied by the indecisiveness of ship deployment. The threat during this long period of time has not stood still. This very behavior vindicates the often heard allegations that the system would become "obsolete during design." In fact, without early attention

Digitized by Google

to modularity and channelization, such adaptiveness would not have been possible. Examples of such change include:

(*a*) Changing the missile receiver from conical scan to monopulse, yielding much greater electronic countermeasures immunity.

(*b*) Increasing system availability due to reduced parts count, modular and "fail soft" design of computer programs, rapid computer program reconfiguration capability, and on-line, automatic fault detection and fault isolation.

(*c*) Doubling of the system target track capability, thus greatly increasing the knowledge of surrounding environment permitting better response thereto.

(*d*) Extension of the AN/SPY–1A search volume capability both in altitude and in range. In fact, zenith search coverage is possible if ordered.

(*e*) Halving of reaction time in certain adverse environments.

(*f*) Reducing manning requirements by approximately 15%.

(*g*) Weight reduction amounting to several hundred percent in some cases has been realized, permitting installation in much smaller ships.

(*h*) Decreasing the prime power requirements by 200 KW without sacrificing performance.

(*i*) Increase in the ability to detect [deleted].

(*j*) Use of AN/SPS–1A target data to provide control of the 5''/54 guns against air targets.

Thus, the visionary application of digital control, modularity and channelization in the original design has allowed repeated enhancement of capability in response to threat change or technological advancement. The judicious application of current technology in a fashion permitting change easily has repeatedly been demonstrated.

Senator HART. How many generations of new anti-ship missiles could the Soviets design and product in the time interval before the last planned Aegis ship will be delivered?

Admiral MEYER. If we take 1990 as an approximate date when "the last planned Aegis ship will be delivered", that is 13 years away. In that time surely the Soviets will design and produce more sophisticated anti-ship missile systems. As in the U.S., most of those advances will be evolutionary, and it is not clear just when a "new generation" should be credited. If this judgment rests on a significant new challenge to Aegis defenses, for instance by a notably new approach trajectory, speed, or targeting and guidance technique, then experience suggests that a "generation" might come at about a ten-year interval. It is a consequence of technology growth as converted to production and Fleet introduction. No firm prediction can be ventured.

Aegis is estimated to be up to most of the threats foreseen for 13 years and beyond, but there are uncertainties, and in a few qualities an advance in Aegis is deemed important. The foremost of these are to tal force coordination, and more maneuverable missiles. Aegis can accept such advances without essential reengineering, and appropriate developments are planned or underway. This need for updating will no doubt continue indefinitely, as the enemy capability increases responsive to our capability. Its design was foresighted as to initial threats, and fundamental in respect to a firm basis for extension. As the threat continues to advance, the appropriate extension must continually be examined and implemented when required.

The Soviet anti-ship missile technology is not estimated to be more advanced than our defense technology, and there are no immediate signs that they can forge ahead in the developmental duel. The effort being applied, however, is very great, and we cannot prudently pause.

Senator HART. What capability would the Aegis system have against a ballistic anti-ship missile such as the SS–N–X13?

Admiral MEYER. [Deleted.]

Senator HART. Have you compared the cost and capability of Aegis with the cost and capability of a combination of Sea Phoenix, incorporating the improvements in ECM capability proposed by manufacturers, with the British Sea Wolf antimisile system?

Admiral MEYER. Yes. The Sea Phoenix conceptual system has been examined in depth in past years in order to determine whether the excellent airborne AWG 9 radar could profitably be used for shipboard defense, along with the Phoenix missile. The conclusion was not favorable. The primary limitations were in the radar, where in adapting from aircraft to ship usage the design was not suitable. Two of the most serious difficulties were: (a) a restricted field of view,

Digitized by Google

suitable for the ahead-looking radar on a combat aircraft being vectored to its target by external help but not for the essentially hemispheric coverage needed on the ship, and (b) a less flexible environmental acceptance in respect to jamming and low-over-the-water surveillance, again suitable for the aircraft but not the ship. An attempt to adapt the airborne equipment to the ship needs, by multiple radar installations, additional signal processing, and integration of several sensors tended to drive the complexity, power, size up to the levels of a system designed initially for ships, without the advantages of dedicated design for the purpose.

The resulting Sea Phoenix concept ended up not only with engineering and performance penalties, but in practice would provide less true "area" defense than shipboard systems designed for the purpose; that is, Sea Phoenix was more suitable for defending its own ship than others in company. The serious proposals were confined to this role, as on aircraft carriers. Aegis has a different purpose.

It is noted that the Institute for Defense Analysis, in independent (non-Navy) study of Aegis for DDR&E examined Sea Phoenix as a possible alternate, and concluded that no advantage was offered, taking account of performance, cost, and readines for use.

The British Sea Wolf is a very short range "point defense" system which might in principle be a supplementary inner defense in Aegis ships or any other area defense ship. It has not been examined explicitly with Sea Phoenix or Aegis.

Senator HART. What is the probability that an anti-missile system such as Aegis, which was designed in the early 1970's, will be highly effective against the threat of the year 2000—by which fear our Aegis platforms will still all be relatively new ships?

Admiral MEYER. It is clearly not possible to foresee the potential of weapons that far ahead, and no current plan should be allowed to depend sensitively on a rigid technological assumption for the future. However, since new combat systems and new ships take many years to develop and acquire, some plan must be set and adhered to in order to bring new capability into the Fleet at all. The guiding principles here are that the plan should: (a) be based on such fundamental advances in systems as can be expected to prove valuable regardless of the particulars of technological evolution (e.g., fast reaction, maximum usable range, large capacities for target surveillance, insensitivity to environment) and (b) permit extensions and supplements into new levels of capability (e.g., modular, reprogrammable, alternate major components as launchers, seekers, fuzes, displays, without destroying the basic system architecture, shared functions among systems or ships). The Aegis program has consciously and conscientiously been guided by these principles. The result is that now, almost ten years after its formulation, no alternate approach has been devised nor thought necessary to meet the requirements as now perceived.

It would be foolish to assert that Aegis can in fact do everything that will be wanted of it in 1990. It would equally be unwise to abandon it because time has passed and some needed future extensions are beginning to be discerned. Those now clearly understood are being addressed and do in fact fit in the basic system concept. The capability expectations are adequate, keeping the system plan intact and evolving in an orderly timely manner.

The pace of change constrains the enemy as much as ourselves, or perhaps more if we retain our leading technological vigor.

Senator HART. Will it cost more for the United States to field Aegis in the numbers now planned or for the Soviets to field new types of anti-ship missiles to counter the Aegis effectively?

Admiral MEYER. The type of missile which the Soviets might introduce to "counter the Aegis effectively" is not now evident. Given the capability of Aegis against current-type threats, some significant new advance would have to be introduced to overcome Aegis defenses decisively. By the year 2000 this may well be possible; but it will require advanced technology and development. By the pattern of Aegis development itself, such a substantial step forward might cost the Soviets several billion dollars for development alone, with the deployment into submarines, ships and aircraft costing additional large sums, dependent on the

Digitized by Google

extent of building or retrofitting the launching vehicles. It would be raw guessing to quantify such a program.

However, if technology supports such an advance, it is quite likely that the attack increment will in a generalized sense cost less than the defense increment represented by Aegis. The offense and defeense are not symmetric in these respects. Fleet anti-missile defense as a whole may well cost more than the enemy's cost of presenting the threat. The military value of providing the defense are best assessed in terms of missions made possible, not dollar burdens on the protagonists. We should bear in mind that our Aegis ships, along with non-Aegis ships in company, will be armed with significant quantities of anti-ship missiles (e.g., Harpoon and Tomahawk.) An effective defense against the attack mounted by such an armada, requires that the Russian Fleet have an Aegis-like defense system.

Senator HART. To what degree have redundancy and degraded modes of operation been built into Aegis?

Admiral MEYER. A very high degree. Parallism and redundancy permeate the design. This parallelism inherently provides the benefits of availability and survivability attributable to redundancy and degraded mode operation. Parallelism providing functional redundancy is more cost effective than outright equipment redundancy. The Aegis system makes extensive use of parallelism, resorting to equipment redundancy in a few critical areas where the more cost effective parallelism approach is not practical.

In a number of areas, the Aegis system combines parallel but independent equipment chains to perform a single function so that equipment loss may degrade performance without loss of functional capability. The thousands of phase shifters in the AN/SPY-1A Array, for example, combine to steer the radar beam. Loss of a number of these results in only a slight degradation of the total power output, antenna gain, and tracking accuracy, and minimal degradation of the capability of the Aegis system to perform its mission. Similar considerations apply to the High Power Amplifiers in the AN/SPY-1A Transmitter, where 32 amplifiers combine to provide the total output power. Again, within the AN/SPY-1A signal processor, parallel equipment channels corresponding to frequency subchannels are summed at their outputs to provide detection and tracking data. Any one of the subchannels can provide the data, albeit with degraded performance.

Another form of parallelism utilizes nearly identical equipment chains performing independent but closely similar functions. If one equipment is lost, the Aegis system is reconfigured to maintain the most important functions. In the AN/SPY-1A receiver, identical equipment chains are used for clear and electronic counter-countermeasures (ECCM) channels. Loss of a clear channel results in substitution of equipment from the least important ECCM channels. The least important ECCM function is degraded, not lost, while the most important ECCM function and the clear function are maintained at full capability.

This type of parallelism is also used extensively in the central computer complex. The three central Aegis standard computers (Weapon Control System, Command and Decision and AN/SPY-1A control) are 4-bay AN/UYK-7s suites. Any 3 bays of a 4-bay suite are capable of performing the immediately essential functions required of the suite by dropping lower priority functions. Automatic fault detection circuitry in the computers recognizes computer equipment failure and the system automatically identifies the failed computer bay, isolates it, and reloads a three bay "casualty" computer program. This is accompished in less than 18 seconds.

Parallelism is a key element of the display system. The consoles are interchangeable, not only in anequipment sense, but most are also interchangeable in a control sense. That is, one console may take on the display and control functions for many different operator positions, either one at a time, or in combination through sequential call up. Consequently loss of one console may at best mean that another console corresponding to an operator position not being used takes on the functions of the failed one, or at worst that the least important operator functions are degraded or sacrificed.

Digitized by Google

As mentioned previously, equipment redundancy is used where necessary to preserve critical functions and where parallelism is not practical. A primary example of the use of redundancy is in the Driver-Pre-Driver stages of the AN/SPY-1A transmitter. Three Drive-Pre-Drivers are provided, any two of which are used at one time to feed the transmitter, with the third standing by. A second example of equipment redundancy is found in the low voltage power supplies forcertain critical functions where standby equipment is automatically switched in upon automatic detection of a failure by the Aegis Operational Readiness Test System.

The entire design philosophy is predicated upon parallelism, redundancy and degraded operational modes. These features have had extensive and intensive scrutiny during the design process and have been proven in many aspects during three years of testing of the EDM-1 system in the test ship, USS *Norton Sound*, where thousands of hours of data have been accumulated.

Mr. CROMWELL. We will put the SM-2 program into the record, rather than giving it; and we will move into questions on it.

[Information to be furnished for the record follows:]

SM-2 PROGRAM REVIEW

The basis for the SM-2 program is the Aegis DCP No. 16 dated 1969. The design of the missile has evolved from SM-1, which has been in production for about 10 years and, like SM-1, is in two configurations, a medium range missile for Aegis-Tartar ships and an extended range missile for Terrier ships. The changes to SM-1 were to add mid-course guidance capability, inertial navigation and improve the ECCM characteristics of the missile. The reult provided an ECCM hardened missile with [deleted] the range of SM-1 and greatly improved fire power potential.

Commonality between the SM-2 (MR) and (ER) configurations of standard missile have been maintained. The white elements shown on this photograph are common to the Standard missile-2 MR Aegis-Tartar ships and ER Terrier ships. The red are the items for an extended range round consisting mainly of Plate 3T, an adaptation made to the harness again shown in red, and necessary hardware for the extended range rocket motors, which consists of the SM-1 sustainer and booster. The medium range round is shown in purple and again the white is common between the two missiles. The propulsion and ordnance sections are common with the SM-1 missile, as well as the air frame and aerodynamic characteristics of the missile.

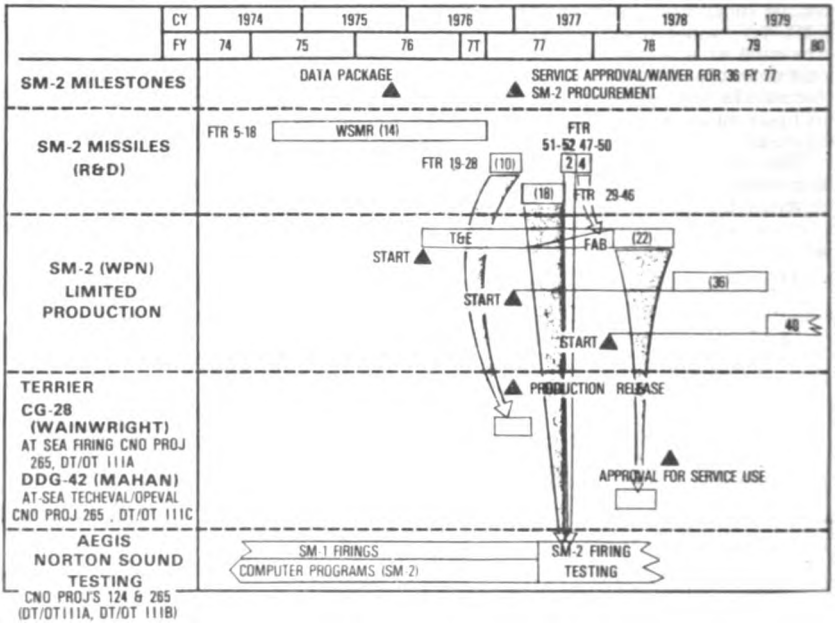
The principal pay-offs of SM-2 are shown here. These include [deleted] the intercept range, up to [deleted] times greater firepower, and a significant improvement in ECM hardness.

This Vu-graph shows a schedule summary. R. & D. rounds are shown at the top. It should be noted that FTR-5 through 18 missiles with monopulse receiver, have been successfully tested at the White Sands missile range. The next 10, FTR 19-28, have also been tested with the Terrier system in U.S.S. *Wainwright* with a spectacular success record. [Deleted] of the final six rounds, four (ER)'s will be used for production test equipment proofing and [deleted] and two (MR)'s for follow-on tests from U.S.S. *Norton Sound*.

WPN procurement is as shown on the next block, 22 ER missiles for TECHEVAL/OPEVAL testing [deleted] now under procurement, and the first ship loadout procurement of 36 missiles in fiscal year 1977 and 40 missiles in fiscal year 1978.

Digitized by Google

SM-2 TEST SCHEDULE



This Vu-graph shows the boundaries of the SM-2 medium range (MR) and extended range (ER) rounds and the location of eight successful intercepts achieved in the flight test series at the White Sands missile range completed September 1976. These missiles were successful against a wide variety of target conditions, including jamming and nonjamming, extreme range and in one case a close-in [deleted] maneuvering jamming target. The last two flights of the series, FTR-23 and 24, occurred on the same day, 16 September 1976, against stringent targets at the extreme (ER) intercept boundary [deleted]. The successful conclusion of the WSMR tests paved the way for the next series of 10 firings from U.S.S. *Wainwright* which are described next.

SUCCESSFUL SM-2 INTERCEPTS

[DELETED]

Indicated are the successful U.S.S. *Wainwright* SM-2 intercepts. There were seven successful system intercepts. However, from a missile standpoint, there were eight successful missile flights. This eighth missile, not shown, was within 12 seconds of perfect intercept when target illumination by the ship radar was lost due to target problems and consequently the missile was not provided with a guidance signal. One of the remaining missiles was a partial success. A rupture of the SM-1 MK 30 sustained rocket motor occurred during flight. One missile

Digitized by Google

failed due to a faulty battery—a modified SM–1 battery which slowly lost power during flight. Of the seven successful systems intercepts, four were direct hits, one was a warhead kill, two others were lethal hits, all less than [deleted] from the target and well within warhead lethal range.

Fiscal year 1977 activity has been highly successful and extensive. Two Aegis at-sea firings of SM–2 (MR) have occurred from U.S.S. *Norton Sound*. The first was a direct hit and the second a lethal hit. These two rounds followed the successful test of an SM–2 acquisition test vehicle. In addition, the fiscal year 1977 procurement of 36 ER missiles was approved by the Navy Acquisition Review Committee on 17 December 1976. Planned activities are shown on this chart and include fabrication of remaining SM–2 (MR) rounds for the continuation of the AEGIS/SM–2 at-sea firings, command link improvement investigation of the Aegis/SM–2 at-sea firings, command link improvement investigaimprovements.

SM-2 FY 77 ACTIVITY

- TO DATE:
  - SECOND AEGIS/SM-2 ACQUISITION TEST VEHICLE - SUCCESS
  - FIRST TWO AEGIS/SM-2 FLIGHTS
    - BOTH SUCCESSFUL
  - ACQUISITION REVIEW COUNCIL
    - APPROVED FY77 ER PROCUREMENT
- PLANNED:
  - COMPLETE FABRICATION/ASSEMBLY SM-2 (MR) ROUNDS (20)
  - CONTINUE AEGIS/SM-2 AT-SEA FIRINGS
  - CONTINUE COMMAND LINK INVESTIGATIONS
    - TERRIER - SECURITY
    - AEGIS - INCREASE DESIGN MARGIN
  - ADDITIONAL ECCM TESTING
  - MISSILE ANTENNA IMPROVEMENTS

Our recent tests show that in SM–2 (ER), we have some command link improvements that are needed. Further, it is desirable to improve the match between the SM–2 (MR) uplink receiver digital decoding techniques and the Aegis shipboard SPY–1 radar system. These continuing command link investigations are planned for iscorporation during fiscal year 1978.

SM-2
FY 78 OBJECTIVES

- COMMAND LINK INVESTIGATIONS
  - INCORPORATE DESIGN CHANGES
- CONTINUE LIMITED AT-SEA AEGIS/SM-2 FIRINGS

Digitized by Google

At-sea firings from U.S.S. *Norton Sound* are now in progress consisting of a total of [deleted] SM-2/Aegis rounds. Two have been fired to date. Approximately four of these rounds will remain to be fired and evaluated in late fiscal year 1977 or early fiscal year 1978.

Shown are the task break-outs and activities associated with the allocation of resources during fiscal year 1977 and fiscal year 1978.

SM-2
FY77-78 RDT & E FUNDING

PE 64366N
(S0176-AA)

($M)

TASKS	*ACTIVITIES*	*FY 77*	*FY 78*
DEVELOPMENT, FABRICATION, ASSEMBLY & TEST	GD/PD, CAL., APL/JHU, MD., NWC/CL, CAL., NWS/SB, CAL.	7.4	1.6
SUB-ASSEMBLIES (PROPULSION, ORDNANCE, TM)	ATLANTIC RESEARCH, VA., PIQUA, OHIO, ECI, FLA., NAFI, IND., MOTOROLA, ARIZ., NOS/IH, MD.,	1.	0
TEST & EVALUATION	GD/PD, CAL., APL/JHU, MD., VITRO, MD., NOMTF/WSMR, N.M., FLTAC, CAL., NSWSES, CAL.	2.3	.1
ENGINEERING SUPPORT & ANALYSIS	APL/JHU, MD., NSWC/D, VA., PMTC, PT., MUGU, CAL., NWHL/E, N.J.	1.2	.4
	TOTAL	11.9	2.1

This segment of the presentation addresses the cruiser AAW weapon system often called the Terrier system, This system includes the extended range version of the Standard missile.

The appropriation elements which support the Terrier weapon system and the extended range missile. There are six R. & D. programs, all except telemetry will be discussed in greater detail in the presentation. The telemetry program is for the development of a telemetry unit for the SM-2 missile. This program will complete in fiscal year 1978. The WPN appropriation is primarily for procurement of the new SM-2 missiles. A portion is for support and modification to SM-1.

Digitized by Google

TERRIER
FUNDING SUMMARY ($M)

			FY 77	FY 78
RDT&E			25.9	51.7
	P. E.	*PROJ. NO.*		
SM-2 MIDCOURSE GUIDANCE	64366N	S0176-AA	6.0	1.0
CG/SM-2 SHIP SYSTEM	64352N	S0170-AA	9.2	5.6
NEW THREAT UPGRADE	64352N	S0188-AA	4.0	14.0
ER IMPROVED	64366N	S0189-AA	5.0	24.5
TELEMETRY	64352N	S0171-AA	1.3	.6
SM-2 W/H			.4	6.0
WPN			48.7	54.1
SM-2 ER MISSILE PROC	P-1 22, BA-2		39.9	41.5
SM-2 ER INITIAL SPARES	P-1 39, BA-2		.7	2.0
SM-1 ER FLEET SUPPORT	P-1 22, BA-2		5.9	6.2
SM-1 ER MODS	P-1 37, BA-2		2.2	4.4
OPN			28.3	53.8
CG/SM-2	P-1 254, BA-4		0	8.0
TERRIER SMS ORDALTS	P-1 254, BA-4		25.4	36.5
AN/SPS-48 RADAR	P-1 57, BA-2		2.9	9.3
O&MN			20.1	19.8
REWORK & MAINT. MISSILE STD-ER			8.6	7.5
REWORK & MAINT. MISSILE TERRIER ER/TERRIER SHIP SYSTEM			5.9 5.6	6.3 6.0
TOTAL				
			123.0	179.4

This is a further breakdown of the funding which supports the Terrier weapon system showing the major activities involved. The first item (the SM-2 ship system development will be disculled in greater detail in subsequent vugraphs. The remaining elements fall into three major areas of activity.

CG/SM-2 WEAPON SYSTEM

TASK	ACTIVITY	FY 77	FY 78
SM-2 SHIP SYSTEM DEVELOPMENT P. E. 64352N	APL/JHU, LAUREL, MD VITRO, SILVER SPRING MD ELECTRONIC COMM INC ST. PETERSBURG, FLA. RAYTHEON, WAYLAND, MASS	9.2 R&D	5.6 R&D
SPS-48 RADAR MODIFICATION AND PROCUREMENT	ITT GILFILLAN, VAN NUYS, CA UNIVAC, ST. PAUL, MINN	2.9 OPN	9.3 OPN
TERRIER M FIRE CONTROL SYSTEM PROCUREMENT	SPERRY, GREAT NECK, NY OCEAN TECHNOLOGY, INC., BURBANK, CA UNIVAC, ST. PAUL, MINN	25.4 OPN	36.5 OPN
FIRE CONTROL IN-SERVICE ENGINEERING AND FLEET SUPPORT	NSWSES NAVSEACENLANT/PAC	5.6 O&MN	6.0 O&MN

Digitized by Google

The radar modification involves procurement of the automatic detection and track capability in the AN/SPS–48 three-dimensional surveillance radar. This radar is the primary air search radar not only for the Terrier ships, but also for the nuclear Tartar cruises (CGN–36 and CGN–38 classes), some cariers two amphibious command and control ships and some foreign ships. The automatic detection and track capability significantly improves target handling by eliminating manual target processing by the radar operators. Procurement of this automatic detection and track equipment, as well as additional AN/SPS–48 radars was initiated in fiscal year 1976. Automatic detection and track kit procurement will continue in fiscal year 1977, and fiscal year 1978.

Secondly, continuation of the on-going Terrier fire control system procurement is shown. This modular change to the Terrier weapon system involves conversion to digital fire control and major improvements to the Terrier fire control radar. These changes form the baseline configuration for the Standard missile–2 modifications. The fiscal year 1978 budget submission supports procurement of equipment for nine ships which will be available for conversion during their next regular overhaul.

Finally, the basic Terrier weapon system in-service engineering and fleet support is shown in the O & MN account.

There are 33 ships now with Terrier systems, in both Atlantic and Pacific Fleet. This number includes Belknap. The 20 ships of the CG–16 and CG–26 classes are scheduled to be upgraded to utilize the SM–2 missile, the CG/SM–2 program.

This picture of USS *Wainwright* highlights the primary equipments which represent the modifications required to implement the SM–2 capability in these cruisers. The modification includes some new equipment, modified equipment, and computer programs.

Thru the use of an inertial reference unit in the SM–2 missile, the SM–2 missile employs an inertially guided mid-course phrase of flight wherein the missile navigates itself to the vicinity of the target. Semi-active terminal guidance, supported by target illumination by the Terrier guided missile fire control system, is used to complete the engagement. The inertial reference unit and guidance computer in the missile in initialized by the new weapon direction system MK 14. Target data is derived from the modified AN/SPS–48 radar and ship attitude and velocity is provided from the new shipboard gyroscompass equipment (SGCE). A new downlink receiving system (AN/SYR–1) is added to receive missile position, velocity and state data as computed by the missile during flight. The Terrier guided missile fire control system is modified to provide uplink communication with the missile to allow transmission of updated target information and mode control to the missile. The Navy tactical data system is modified to accommodate the command and control interface changes required.

Of significance is the decrease in target processing time which is derived in the CG/SM–2 system. In current fleet systems, a series of sequential and manual operations are involved between target detection and missile launch which can take up to several minutes to accomplish. Additionally, the Terrier guided missile fire control radar must acquire and track the target prior to missile launch. With the CG/SM–2 system, all target detections are passed to ntds and those targets ordered for engagement by the Terrier weapon systems are automatically passed to the weapon direction system. Target data on these later targets is then obtained directly from the AN/SPS 48. The missile is initialized targeted and launched based on this search radar data. Subsequent to launch, the fire control radar is assigned to provide target illumination for the terminal phase of flight. Through use of this "launch on search" concept and more automated target processing, we should achieve a reaction time of [deleted].

Last year the presented schedule indicated at-sea testing of the system during fiscal year 1976. Now we report this at-sea test was successfully completed on *USS Wainwright*, with the increased capability of this system fully demonstrated. On one test, two missiles were simultaneously in flight to engage two separate targets, controlled by a single fire control system. Following the at-sea tests, production of this system for Belknap was authorized.

Digitized by Google

During 1977, the system is being configured for production and full capability in preparation for the next level of testing and evaluation. Equipment must be modified to complete the system configuration for production. Computer programs must be expanded to provide full tactial capability.

CG/SM-2 (ER)
FY 77 PLANS

- EXPAND FIRE CONTROL SYSTEM MODS TO FINAL CONFIGURATION
  - — INCORPORATE AT-SEA EVALUATION RESULTS
  - — EXPAND TO FULL TACTICAL CAPABILITY
- CONTINUE COMBAT SYSTEM INTEGRATION
  - — NTDS COMPUTER PROGRAM
  - — AN/SPS-48C RADAR
- RESUME LAND BASED TESTING
- COMMENCE PRODUCTION OF EQUIPMENT FOR USS BELKNAP
- CONTINUE SM-2 (ER) MISSILE PRODUCTION

During 1978 the next series of testing will be conducted, following the testing concepts used in 1976 for the initial level of evaluation. This will include land-based testing of system equipment and computer programs prior to going to sea for operational evaluation at the end of 1978.

CG/SM-2
FY 78 OBJECTIVES

- CONDUCT LAND BASED TESTING OF FULL CAPABILITY COMPUTER PROGRAMS AND PRODUCTION EQUIPMENT
- COMMENCE OPERATIONAL EVALUATION
- PROCURE SECOND SHIP SYSTEM

Digitized by Google

88-379 O - 77 - 23

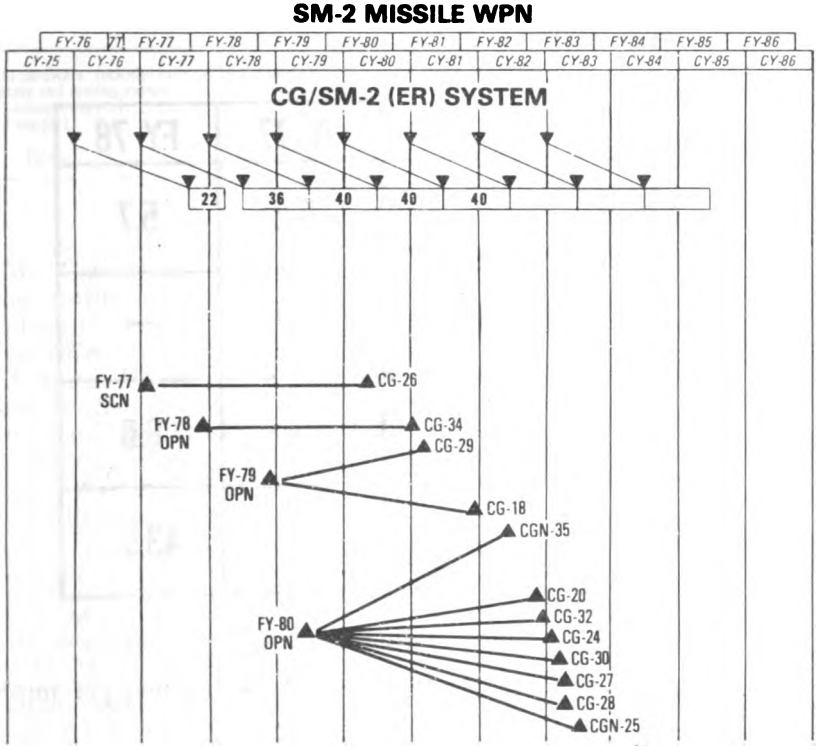
During these years a small quantity of the SM–2 missiles are being produced to support system testing and tactical load out of the initial SM–2 converted ship.

SM-2 (ER) PROCUREMENT (WPN)

- *FY-76: ($48.5M)*
  - PILOT PRODUCTION (22 ROUNDS) FOR CG/SM-2 TECH/OPEVAL
- *FY-77: ($40.6M)*
  - PROCURE 36 ROUNDS FOR BELKNAP LOADOUT
  - TEST EQUIPMENT FOR NAVAL WEAPON STATION
- *FY-78: ($43.5M)*
  - PROCURE 40 ROUNDS FOR SECOND TERRIER CRUISER

Digitized by Google

The schedule for installing this capability in our missile cruisers is shown, with one ship system procured in each fiscal year 1977 and fiscal year 1978. This will be stalled on ships during regular overhaul periods.



Digitized by Google

This funding supports the program for fiscal year 1977 and fiscal year 1978.

CG/SM-2 FUNDING

	FY 77	FY 78
RDT&E	9.2	5.7
SCN (BELKNAP)	14.7	—
OPN	—	8.0
WPN	40.6	43.5

SM–2 MISSILE COSTS

Mr. CROMWELL. Why is the SM–2 costing $1 million per missile again this year?

Admiral MEYER. Mr. Cromwell, it is simply a mater of the numbers of procurement. The quantities are something like 40 in the buy, and the costs will stay that way with those kinds of quantities. We believe if we could get the quantities up to 200 or 240, which, I think, is a reasonable rate as far as fleet introduction, that cost will come down. It will come down at least by half.

On the other hand, the Navy has a very real problem of how many ships it can fund to be converted; so I am in a Catch–22.

If I could build more missiles, the cost will come way down. I am just not in a position for my sponsors to authorize me to build more missiles at the moment.

Mr. CROMWELL. Would you provide for the record a detailed funding breakdown on the SM–2 missile procurement program? Break that down into missile hardware and support costs and all the other.

Admiral MEYER. Yes, sir; we will.

Mr. CROMWELL. Funding factors.

Admiral MEYER. Yes, sir.

[The information follows:]

Digitized by Google

A detailed funding breakdown of the SM-2 Missile Procurement Program is as follows:

[Dollar amounts in thousands; fiscal years]

	1977	1978
Flight hardware: Includes manufacture of guidance and control, ordnance, propulsion and safety and arming device	$24,538	$25,736
Procurement support	10,847	12,054
Fleet support	4,515	3,710
Total	39,900	41,500

SM-2 PRODUCTION PLAN

Mr. CROMWELL. What is your contracting plan for the SM-2; in other words, is the fiscal 1977 procurement for 36 missiles now on long lead contract, and if so, when will it be definitized? When would the fiscal 1978 contract be let?

Admiral MEYER. We anticipate the fiscal 1977 contract being definitized by the 1st of May. That contract contains within it the options anticipated for fiscal year 1978. We would, therefore, expect to move out smartly with the 1978 effort after the Congress appropriates the money. We could, therefore, target that by next December.

[Additional information follows:]

The contracting plan for SM-2 is as follows. Contract N000-24-76-C-5115 (cost plus award fee) has been executed for the fiscal year 1976 procurement of 22 SM-2(ER) missiles plus tools and test equipment. The fiscal year 1977 procurement of 36 missiles is presently under negotiation and definitization as an add-on to the fiscal year 1976 contract. To provide manufacturing continuity, long lead procurement of material (approximately $2.8 million) for the 36 fiscal year 1977 missiles was executed on 20 April 1977 as a mod to the fiscal year 1976 contract. Complete definitization, negotiation and execution of the fiscal year 1977 procurement is anticipated by August 1.

The fiscal year 1978 procurement of 40 missiles will be under a new contract for the following reasons:

(*a*) Two procurement years are enough for a single contract.

(*b*) A new contract will be less complex.

(*c*) The determination of the type of contract, for example, fixed price incentive, is under discussion.

We expect to receive a proposal from GD/P by July 1, 1977 for the fiscal year 1978 procurement and, allowing 6 months for negotiation, we should be under contract by December 1977.

Mr. CROMWELL. Is it on long lead now, fiscal year 1977?

Admiral MEYER. I don't know, sir.

Mr. CROMWELL. Will you provide that?

Admiral MEYER. Yes; I will.

We anticipate long-lead will be under contract by April 1. Prenegotiation clearances are now being obtained for the total fiscal year 1977 procurement. The clearances will be followed by negotiations and award. Plan is to execute no later than May 1977.

Mr. CROMWELL. What is the option date for the fiscal year 1978 buy?

Admiral MEYER. I will have to furnish the exact date for the record.

[The information follows:]

The proposal will be received not later than July 1, 1977 and the award will occur not later than December 1977.

Digitized by Google

Mr. CROMWELL. What is the installation plan out through the FYDP 5-year period?

Admiral MEYER. I would furnish that to you for the record but I would state now that the first production ship installation is targeted for the U.S.S. *Belknap* and related to her reconstruction and return to the fleet.

Contained within the 1978 budget is money for the second ship alteration to handle SM–2's.

Mr. CROMWELL. Then if you could build that for the next 3 years, for the record.

Admiral MEYER. Yes, sir.

[The information follows:]

Admiral MEYER. Present planning calls for installing the CG–SM–2 modifications into the Terrier cruisers (CG) as follows:

Fiscal year 1977, SCN contract, CG–26.
Fiscal year 1978, OPN contract, CG–34.
Fiscal year 1979, OPN contract, CG–18, CG–29.
Fiscal year 1980, OPN contract, CG–20, CG–23, CG–24, CG–28, CG–32, CGN–35.
Fiscal year 1981, OPN contract, CG–21, CGN–25, CG–27.
Fiscal year 1982, OPN contract, CG–17, CG–33.
Lead times include 15 months plus 12 months industrial effort.

Mr. CROMWELL. Has this ship installation plan slipped since last year? If so, why?

Admiral MEYER. There has been an adjustment, as I best recall, from three down to one in procurement plans.

There were two reasons for that, and I am speaking for my sponsor here. One was the money crunch. There was not enough money to sustain three. At the same time, the test and evaluation people brought a lot of pressure to not proceed to buy three; so a compromise came out at one.

Mr. CROMWELL. Is that a Navy internal decision?

Admiral ROWDEN. Yes; it is a naval internal decision.

Admiral DOYLE. The primary reason was the money, limited funds available, and in order to do this and other improvements also.

Mr. CROMWELL. Thank you.

SM–2 SUCCESS RATES

Mr. OLD. Admiral Meyer, what is the required firing and success rate for SM–2? What is the standard you are trying to reach?

Admiral MEYER. In the specification for the missile round reliability itself, we have a requirement of [deleted] with the objective of [deleted].

We have completed the firings at White Sands Missile Range, the developmental firings, and during this past year we completed a series of developmental firings in the U.S.S. *Wainwright*, a cruiser, in the Caribbean, as mentioned earlier, we have commenced the firings in Norton Sound. Those tests, combined with our ground test data are projecting us at something like [deleted] so I feel a lot more comfortable than I felt a year ago on this number.

I feel that there is a firing base now that says that we can attain those kinds of numbers.

Digitized by Google

Mr. OLD. Thank you Admiral Meyer.

Mr. CROMWELL. Thank you very much. Can we move along to the SM–1 Tartar program?

Will you put that in the record.

Admiral MEYER. Yes, sir.

SM–1/TARTAR PROGRAM REVIEW

Good morning. I am Capt. R. R. Hatch, Director of the Medium Range Missile System Division. My presentation will cover the Tartar combat system, including the Tartar ship system, the Standard Missile–1 medium range, and the vertical launch system. The funding for the total program is as shown here.

TARTAR
FUNDING SUMMARY ($M)

			FY 77	FY 78
RDT&E			6.3	19.5
	PE	*PROJ. NO.*		
SM-1 IMPROVEMENT	64366N	S0439-AA	—	6.7
VERTICAL LAUNCH	64369N	S0177-AA	4.0	10.7
MR SHIPBOARD SYSTEM	64352N	S0170-AA	2.3	2.1
WPN			80.1	106.6
SM-1 MR PROCUREMENT	P-1 21, BA2		74.3	102.1
SM-1 MR MODS	P-1 36, BA2		1.9	2.0
SM-1 MR INITIAL SPARES	P-1 39, BA2		3.9	2.5
OPN			12.0	9.1
SMS ORDALTS TARTAR	P-1 254, BA4		12.0	9.1
O&MN			19.4	17.9
REWORK MAINT (STANDARD)			7.7	6.7
REWORK MAINT (TARTAR)			4.5	4.9
TARTAR SHIPBOARD REWORK			.3	.6
TARTAR FLEET SUPPORT			5.9	5.8

The total funding shown on the previous slide is broken down into the areas of research and development, which includes initiation of development of improved capability for the SM–1 medium range missile, a major effort in the vertical launch system, and shipboard system developments. In WPN the major effort is production of SM–1 medium range missiles at a rate to meet the basic shipfill and inventory pipeline requirements. Modifications to existing missiles in inventory and Standard Missile initial spares are also included in the WPN request. The OPN funds cover fire control systems improvements for the DDG–31 and the FFG–1 classes, and equipment for the various Tartar training sites. The O. & M.N. appropriation request provides fleet support for both fire control systems and the missiles.

There are presently 49 U.S. Navy ships deployed with the Tartar weapons system and the Standard Missile–1, medium range. This includes nuclear-powered cruisers, guided missile destroyers, and guided-missile frigates. This fleet will grow to well over 100 ships in the 1980's with the introduction of the FFG–7 class. From this large number of ships derives the requirement for a substantial number of missiles to load the magazines and enable these ships to carry out their

Digitized by Google

operational missions. This substantial fleet and the evolving threat requires that a continuing program of ship system and missile improvements.

In addition to the large U.S. fleet of Tartar standard missile ships, there are significant numbers of allied ships. Currently there are 29 deployed ships in 8 allied navies, with 11 more ships planned. There are also three Terrier ships in the foreign inventory.

The combat systems approach to the Tartar/Standard missile fleet is similar to the general concept shown for a Terrier fleet. The ship system provides the elements of detection, control, and engagement. To engagement is further added the missile capability, which includes Kinmatic performance, guidance, and ordnance factors. These continue to provide over-all systems effectiveness.

This chart depicts the DDG–2 class which will be provided a significant upgrading for which funding is requested in the fiscal year 1978 SCN appropriation. Under this program, the detection capability will be enhanced with the addition of the SPS 52 three dimensional radar, the SPS 65 radar, modifications to the SPS 40 radar, and integrated automatic detection and tracking of all radar targets by the SYS–1. Control improvements will be provided by the weapons direction system MK 13, and the DDG tactical data system, which are based on already deployed systems. Engagement from the ship's system aspect is improved by modification to the basic Tartar MK 74 missile fire control system and addition of the MK 86 fire control system with gun and missile capability. A similar missile evolution is necessary to parallel the ship's capabilities.

SM-1 MR MISSILE PROGRAM

I will now address the standard missile programs themselves. The basic thrust of these programs is the procurement of Standard missile–1 medium range missiles to support the shipfill requirements, SM–1 improvements through product improvement in the WPN line, a new development in R.D.T. & E. with the objective to provide propulsion improvements, and introduction of developments from other programs to improve the medium range missile.

The funding for these two main areas, SM–1 improvement and SM–1 procurement, are highlighted here.

Digitized by Google

TARTAR
FUNDING SUMMARY ($M)

			FY 77	FY 78
RDT&E			6.3	19.5
	PE	PROJ. NO.		
SM-1 IMPROVEMENT	64366N	S0439-AA	—	6.7
VERTICAL LAUNCH	64369N	S0177-AA	4.0	10.7
MR SHIPBOARD SYSTEM	64352N	S0170-AA	2.3	2.1
WPN			80.1	106.6
SM-1 MR PROCUREMENT	P-1 21, BA2		74.3	102.1
SM-1 MR MODS	P-1 36, BA2		1.9	2.0
SM-1 MR INITIAL SPARES	P-1 39, BA2		3.9	2.5
OPN			12.0	9.1
SMS ORDALTS TARTAR	P-1 254, BA4		12.0	9.1
O&MN			19.4	17.9
REWORK MAINT (STANDARD)			7.7	6.7
REWORK MAINT (TARTAR)			4.5	4.9
TARTAR SHIPBOARD REWORK			.3	.6
TARTAR FLEET SUPPORT			5.9	5.8

These are the major characteristics of the Standard missile–1 medium range. It provides the capability to a significant majority of U.S. and free world navies. The Standard missile family has been built on the concept of block changes to meet the evolving threat. It stresses commonality throughout SM–1 medium range and extended range and the SM–2 family. The dual-thrust rocket motor is used in both the SM–1 and SM–2 programs. The missile is a semiactive homing missile and uses a dual-thrust rocket motor providing both boost and sustained power.

The accomplishments of the Standard missile medium range program in 1976 were highlighted by an improvement in missile asset readiness, for which this committee showed great concern during the fiscal year 1975 hearings. I am pleased to report that asset readiness has improved substantially in fiscal year 1976, reaching [deleted] as a result of accelerated missile maintenance and intensive inventory management. During thte past year missiles were deployed with the new, improved MK 45 fuze and the MK 90 warhead which has both a surface target and air target capability.

During fiscal year 1977 our plans for the Standard missile–1 medium range address production and preparation for further improvements. Subject to the approval of reprogramming action submitted by the Navy, we will be able to restore a sustained production rate [to meet ship requirements] the Navy has commenced preliminary work on adaptation of the monopulse seeker from the SM–2 missile program, which will provide a significant improvement in capability to the large numbers of SM–1 ships. Preliminary planning for the fiscal year 1978 MR missile improvement program will be conducted.

TARTAR/STANDARD MR MISSILE ASSETS (PROCUREMENT QUANTITY ANALYSIS)

[DELETED]

Digitized by Google

This chart shows how the requested fiscal year 1977 and 1978 procurements will provide sufficient assets for combatant loadouts, ammunition ship loadouts, and a minimum repair pipeline, [deleted] which is based on threat-scenarios and allocation of attackers to the various AAW systems deployed in the Navy.

The fiscal year 1978 objectives are to continue sustained production to meet the ship requirements as previously described. Tests will be conducted on the adaptation of the SM-2 monopulse seeker to SM-1. In fiscal year 1978 the Navy plans to commence a longer term development for an improved medium range missile drawing heavily on other Standard missile development efforts.

STANDARD MISSILE (MEDIUM RANGE)
SM-1 MR
FY 78 OBJECTIVES

- SUSTAIN RATE PRODUCTION (40/MONTH) TO MEET SHIP REQUIREMENTS
- TEST MONOPULSE SEEKER FOR SM-1
- MEDIUM RANGE IMPROVEMENT
  - COMMENCE DEVELOPMENT
  - FABRICATE PROPULSION HARDWARE/CONDUCT STATIC TEST
  - PHASE-IN STUDY OF ER(1) DEVELOPMENTS

Adaptation of the SM-2 monopulse seeker to SM-1 provides improved performance in ECM environments and against maneuvering targets. This product improvement stresses commonality with the SM-2 production in both procedures and test equipment with attendant benefits to both programs. The effort will emphasize improved producibility through design simplification.

SM-1 GUIDANCE IMPROVEMENT

MONOPULSE RECEIVER PROGRAM

- IMPROVED PERFORMANCE IN CLEAR & ECM ENVIRONMENT
- IMPROVED GUIDANCE FILTER REDUCES TIME CONSTANTS IMPROVED MANEUVER CAPABILITY (MANEUVERING TARGETS)
- HARDWARE COMMONALITY WITH SM-2 MISSILE, TESTERS, PROCEDURES
- IMPROVED PRODUCIBILITY - DESIGN SIMPLIFICATION
- POTENTIAL UPGRADE OF INVENTORY VIA RETROFIT

Digitized by Google

There will be over 150 ships in U.S. and allied navies which employ the SM–1 medium range missile in the 1980's. As inthe past, a conscious effort to improve the missile as a threat evolves is necessary. The SM–1 MR improvement program is designed to meet this goal. The designed commonality of the Standard missile family permits this program to use the monopulse seeker efforts and the warhead and fuze developments of the SM–2 ERI program described. The present rocket motor used in both the SM–1 medium range and SM–2 medium range program is based on 1960's technology. With essentially the same motor size greatly improved performance is now available to engage the projected threat. These three elements: seeker, propulsion, and ordnance, well within the current technology will be combined in the SM–1 MR improved development program.

SM—1 (MR) IMPROVEMENT

OBJECTIVE:

- IMPROVED CAPABILITY AGAINST EVOLVING THREAT

APPROACH:

- GUIDANCE EFFORT
  - ADAPTATION OF SM-2 MONOPULSE SEEKER
    - (WPN-PRODUCT IMPROVEMENT)
- PROPULSION EFFORT
  - DEVELOPMENT OF NEW MOTOR AND ASSOCIATED GUIDANCE/AUTOPILOT CHANGES
    - (RDT&E)
- FUZE/ORDNANCE
  - ADAPTATION OF EFFORT FROM SM-2 ERI PROGRAM
    - (RDT&E)

Digitized by Google

This chart shows the interchange of developments between the SM-1 MR improved the SM-2ER improved and the SM-2MR improved in order to improve overall AAW missile performance in efficient and economical manner.

COMMONALITY IN ACTION

INITIAL CONFIGURATION	SM-1	SM-2	
IMPROVEMENTS	MR	MR	ER
DUAL THRUST ROCKET MOTOR	(X)	X	
BOOSTER			(X)
+ G+ MANEUVERABILITY CONTROL	X	X	(X)
+ G+ FRAG VELOCITY WARHEAD	X	X	(X)
SEEKER ECCM SOJ	X	X	(X)
IMPROVED CONFIGURATION	MR (I)	MR (I)	ER (I)

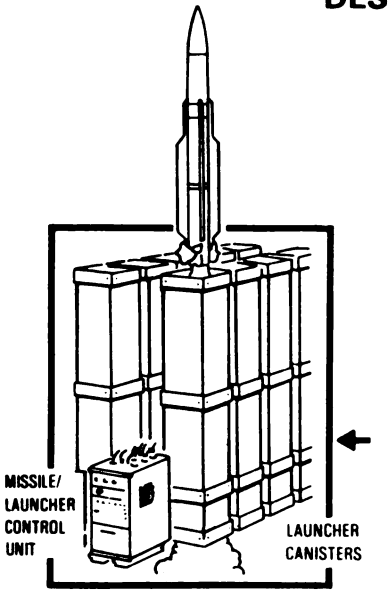
The next program to be discussed is the vertical launch system.

The vertical launch system has evolved from the successful feasibility demonstrations conducted under program element (PE) 63358N, weaponizing prototype. The Navy has established an operational requirement for a vertical launch system capable of firing anti-air, anti-submarine and anti-surface missiles, for introduction into new construction such as the AEGIS ships and selected retrofits.

Vertical launch is designed to: allow us to increase our available firepower; provide greater availability, increase flexibility of weapon selection; provide simplicity.

Digitized by Google

VERTICAL LAUNCH SYSTEM DESCRIPTION



MULTI-MISSILE CAPABLE: SM-1 (MR), SM-2 (MR) HARPOON, ASROC, AMR

SHIP CANDIDATES: PRIMARY - AEGIS
SECONDARY - AAW CONVERSION

CHARACTERISTICS: FIXED SYSTEM; INBOARD INSTALLATION; CANISTER FOR TRANSPORT, STRIKEDOWN, AND LAUNCH; INDIVIDUAL BLAST DOORS; HIGH FIRE RATE; OMNI-DIRECTIONAL FIRE

Phase I of the vertical launch prototyping program was completed in 1975. In 1976 phase II was completed in which the Navy demonstrated vertical flight characteristics under stringency conditions encountered in high relative winds. Four missiles were launched successfully from a high speed sled at speeds up to 120 knots. This phase was completed with a successful firing from the surface effect ship (SES 100B).

A system specification was developed to quantify our performance requirements. This specification served as the basic requirements to industry for their full scale development proposals.

Finally, we carried out the transition into full scale development.

In fiscal year 1977 phase III was management feasibility demonstrations were carried out at the Naval Weapon Center, China Lake, Calif., using a two canister prototype launcher. Two flyout firings were conducted which proved the basic concepts. These were followed by a successful restrained firing of a MK 56 rocket motor on January 14, 1977. The structure handled the full burn of this extremely powerful motor satisfactorily. Both canisters remained reusable and no degrading effects on the missile in the adjacent cell were observed.

These firings complete the technology demonstrations in the vertical launch prototyping program.

We are currently conducting a source selection to choose a contractor to enter into full scale development. Proposals were received on 1 February 1977, and are currently being evaluated.

Our intent is to award a contract to one of the bidders by 1 May. This will allow initiation of detail design and ordering of long lead hardware for fabrication of the engineering development model and associated test units.

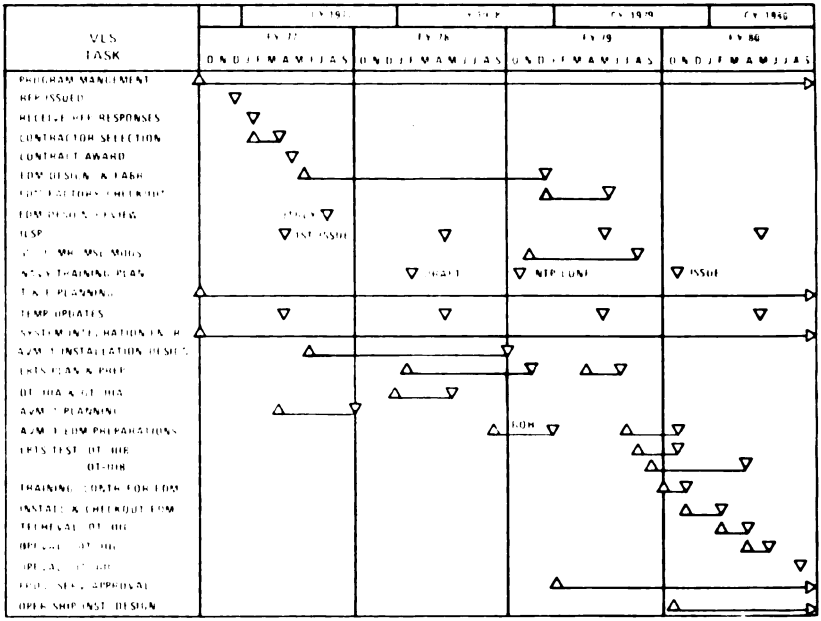
In fiscal year 1978 we have identified these major tasks. This year will see the bulk of the effort to complete engineering development model design and fabrication, in order that factory acceptance tests can proceed in early fiscal year 1979. USS *Norton Sound* is scheduled to enter the shipyard in August 1978 for overhaul, at which time we must have the installation design complete so that cables can be installed and spaces modified to accept the engineering development model at the end of land based testing. We will establish the land base test site and commence subsystem testing.

Digitized by Google

The overall schedule is shown here. Fiscal year 1977 is oriented towards transition to engineering development and competitive selection of an industry team. In fiscal year 1978 the major effort is in actual hardware fabrication and site preparation, both in USS *Norton Sound* and the land base test site. In fiscal year 1979 we plan to complete fabrication and move into the test and evaluation phase which extends through fiscal year 1980.

VERTICAL LAUNCH SYSTEM

ENGINEERING DEVELOPMENT SCHEDULE



In summary the requested funds for the Tartar combat system effort supports a significant number of existing ships and missiles, provides continuing procurements to support these ships and a development program to provide improving capability for the future.

SM–1 IMPROVEMENTS

Mr. CROMWELL. It appears the medium range version of the SM–2 will not be put in production now, but will be superseded by the so-called SM–1MR Improved. That missile sounds like it is the old SM–2, but utilizing only the monopulse guidance, omitting the midcourse guidance system.

Is that a valid interpretation of the material that has been presented here today?

Admiral MEYER. Substantially correct, sir. The Standard Missile 2 medium range completed its development for Aegis, although the Navy would like to put Standard Missile 2 medium range into our Tartar Ships.

Again, fiscal realities have not permitted us to do so. We have, therefore, pursued a program with Standard Missile I which is beneficial to both programs in an effort to get a broader production base in our

Digitized by Google

factory, and upgrade the missiles flowing into Tartar fleet inventory.

We are taking the monopulse receiver which has enjoyed, I might say, outstanding success in the Standard Missile 2 firings and we will refit that into our Standard Missile I. We have some product improvement moneys in the 1978 line to do so. In addition, we will change the present MK-56 rocket engine which has been in service for 7 years, to a higher performance engine using available propellants.

This will be significant upgrade, then, of Standard Missile I's capability.

So the Tartar ships will get the benefit and the fruits of the SM-2 development, but will, of course, not receive the midcourse guidance which is a substantial increase in cost as well as capability.

Mr. CROMWELL. Will the SM-2MR be used on the ships?

Admiral MEYER. Yes, sir, it will.

(Additional information follows:)

No, sir, the DDG Tartar system is not planned to have the capability to provide mid-course guidance as is done in Aegis and Cruiser SM-2 programs.

Mr. CROMWELL. What is the development schedule for the monopulse version of the MR missile and when will production of that version begin?

Admiral MEYER. The development schedule and firing schedule are 1978 and 1979, and we anticipate that the Standard Missile I's being produced in 1980 will include the monopulse. They, in our parlance, will be the Block Six missiles.

Mr. CROMWELL. Is that fiscal or calendar year 1980?

Admiral MEYER. That is fiscal.

Mr. CROMWELL. Would you provide for the record the development schedule?

Admiral MEYER. Yes, I will.

[Information follows:]

The Monopulse program for SM-1 is a WPN component improvement effort, as follows:

Fiscal year 1978—Design and build monopulse/SM-1 guidance section interface. Conduct development model validation. Construct flight test plan. Initiate procurement of additional tooling and test equipment for production line.

Fiscal Year 1979—Flight test Block 6 missile to validate design package. Prepare for production including remaining tools and test equipment, production documentation completion.

Fiscal year 1980—Full-scale production units.

Mr. CROMWELL. What is the cost of that development effort in total and by fiscal year?

Admiral MEYER. I would provide that, if I may, into the record.

[The information follows:]

The WPN cost for SM-1 Monopulse follows:

Fiscal year 1978	$11,830
Fiscal year 1979	4,500

The products received are as outlined in previous question.

Mr. CROMWELL. What is the production flyaway cost of the monopulse MR missile, and how does that compare with the current block 5 MR missile, and also the SM-2MR missile?

Digitized by Google

Admiral MEYER. We would anticipate that the monopulse flyaway would be about $172,000, and that compares to about $135,000 flyaway in the 1977 buy.

Mr. CROMWELL. And the SM-2?

Admiral MEYER. And the SM-2 flyaway—I do not have any SM-2MR flyaway numbers here with me.

Mr. CROMWELL. Could you provide that to us?

Admiral MEYER. Yes, I can.

[The information follows:]

The estimated production flyaway cost for SM-2 medium range based on a fiscal year 1979 POM submission is as follows:

Fiscal year 1979:
SM-2 medium range:
Hardware ---------- $464.5
Flyaway ---------- 652.7

No procurement has been approved in the current 5-year defense plan. The above price is based on procuring 60 ER SM-2 missiles and 110 MR SM-2 missiles in fiscal year 1979.

ANNUAL FLEET FIRINGS

Mr. CROMWELL. Looking at your inventory, how many medium-range and extended-range missiles is the fleet firing each year, and also what is your success rate?

Admiral MEYER. We are firing between 200 and 220 per year, about that; the success rate is holding pretty substantially at around [deleted].

I am looking here at 1976 numbers; for example, it says the Standard Missile extended range—that would be the Terrier version—based on the sample of 69 firings had a success rate of [deleted]. That is compared to a lifetime average of [deleted].

The Standard Missile medium range, during 1976 had a success rate of [deleted] with a data base of 92. That is compared to a lifetime average of [deleted].

We feel we are holding quite well.

Mr. CROMWELL. Would you provide a table for the record of all the fleet firings for the year?

Admiral MEYER. Yes, sir; I can.

[The information follows:]

A table for fleet firings is provided as follows:

SURFACE-TO-AIR FLEET FIRINGS

Missile types	Fiscal year 1976 including TQ	
	Number	Success rate
Standard missile (ER)	69	[Deleted.]
Standard missile (MR)	92	
[Deleted] Terrier	72	
[Deleted] Terrier	52	
Improved Tartar	53	
Talos (RIM 8G and 8J)	18	

Digitized by Google

STANDARD MISSILE INVENTORY

Mr. CROMWELL. What is your current inventory position of MR missiles at the end of fiscal year 1977, and what is the calculated inventory requirement at the end of fiscal year 1977?

Admiral MEYER. The calculated requirement at the end of 1977, according to my chart, is [deleted]. The calculated availability is [deleted]. Now, I should amplify on what requirement means.

Requirement means filling all of our warships. It permits 13 percent in the pipeline and 25 percent loaded in our ammunition ships.

Mr. CROMWELL. What is the Navy's NNOR calculated requirement for the medium-range missile?

Admiral MEYER. It is [deleted].

Mr. COMWELL. Now, what is the basis for that calculation? How is that arrived at?

Admiral MEYER. Well, sir, I have to turn to my expert, Captain Hatch.

Captain HATCH. The basis of that is an analysis that is used with the threat, the ships deployed, computing maldistribution and distributing the threat against all AAW systems, both air and surface launched, to come up with a model that says to meet the threat that is postulated you need x number of rounds.

Mr. CROMWELL. Did the Navy change its method of calculating the NNOR?

Captain HATCH. Yes, sir; 2 years ago it was changed to account for a more proper distribution among the different AAW systems, and to account for maldistribution, that is, all ships would not see equal numbers of threats; some will see twice as many and some will see very few, but the ships you outfit, and how many missiles you need, you have to account for that. It is roughly two magazine loads per ship.

Mr. CROMWELL. All right. Could you provide us for the record a summary of the changes that were determined when the model was changed?

Admiral MEYER. Yes, sir.

[The information follows:]

The last budget for which the old method of computing inventory objective (I/O) was applicable was fiscal year 1977. The I/O's for surface-launched AAW weapons as computed under the old and new methodologies are as follows:

System	Old I/O (fiscal year 1977)	New I/O (fiscal year 1978)
Standard (ER)	[deleted]	
Standard (MR)		
Seasparrow		

Mr. CROMWELL. Would you give a breakdown of the MR inventory as to type? In other words, how many are the older Tartar missiles and so on, up to your latest SM-1 block 5? Do that for the record.

Admiral MEYER. Yes; we can.

Digitized by Google

[The information follows:]

A breakdown of Standard Missile (MR) inventory by type is as follows:

Tartar/Standard MR

ITR	Deleted
SM-1 Blk 3/4	
SM-1 Blk 5	

Mr. CROMWELL. What shipbuilding program is used as the basis for the ship fill calculations that were shown on your inventory chart?

Admiral MEYER. Included is the FFG program, and that program calls for 75 that were used in this calculation—excuse me—74, and the existing fleet, there are three more nuclear cruisers to deliver and they are included here.

Mr. CROMWELL. All right. What is the storage life of the missile?

Admiral MEYER. Well, we haven't found any limit on it. We have established that we can go as much as 3 years between tests, and we have now gone to that level.

To give you a little bit of history, a number of years ago these missiles had to be tested every 30 days and every 60 days in their magazines aboard ship.

We went to the no-test program. We were able to remove all of that gear from aboard ship, and we went up to an 18-month level. I think we had some in trial 12 months; then we went to 2 years, and now we feel we can safely go to 3 years between testing. There is little evidence—there is no evidence as a matter of fact, as far as I know—that the missiles degraded electronically within the 3-year storage life.

Of course, their performance in their electronics does not match the threat as they get older and older, so some of our missiles will be found wanting in countermeasure environments.

STANDARD R. & D. PROGRAM

Mr. CROMWELL. Is there a funding request for the standard missile in fiscal year 1978?

Admiral MEYER. Yes, sir, there is for the Standard missile ERI program.

Mr. CROMWELL. Why wasn't that funding request included in the briefing that was given?

Admiral MEYER. I am sorry. I thought it was.

Mr. CROMWELL. How much money is requested, then, what is the 5-year funding profile, development profile for that missile?

Supply the 5-year profile for the record.

Admiral MEYER. All right.

[The information follows:]

Admiral MEYER. The 5-year development funding for SM-2 ERI is as follows:

Fiscal year 1977	5.0
Fiscal year 1978	24.5
Fiscal year 1979	21.4
Fiscal year 1980	10.9
Fiscal year 1981	10.9

Digitized by Google

Mr. CROMWELL. What is the total R. & D. cost for that program?

Admiral MEYER. That total R. & D. cost is approximately $75 million. I would give you the specific number on the record.

[The information follows:]

The total R. & D. cost for the SM-2 ERI program is $85.8 million.

Mr. CROMWELL. What is the justification for the request?

Admiral MEYER. The justification is related to the point that I mentioned earlier. We have to keep up. The enemy doesn't stop as far as his countermeasures development, either electronically or as far as his targets themselves. [Deleted] weapons systems are creating a tremendous challenge to these missiles. The challenge occurs because of the very high altitude from which they are launched, the supersonic conditions under which they fly, and the very high angles that they can dive at us from.

Now, that has occurred while we are working very hard the last few years on the sea skimmer problem, so these missiles have a demand on them that they have to be able to cope with almost the entire hemisphere from the edge of the water right on up to almost the exosphere; so, although the baseline Standard Missile 2 has substantial performance increased over Standard Missile 1, all our projections tell us that we found them wanting, and we must keep fighting the upgrade for it.

Propulsion, primarily is what we are wrestling with now. The monopulse receiver has been shown to be very, very good against the electronics measures.

VERTICAL LAUNCHER USES

Mr. CROMWELL. Regarding the vertical launch development program, would that launcher be of a specific size or would it be adaptable to different featured missiles?

Admiral MEYER. It will be adaptable within some limits. Physically, it will accommodate up to [deleted] in length. The baseline vertical launch design is being driven to house Harpoon and any of the Standard missile family; so the present baseline design will accommodate all of our 13.5 inch missiles and up to as much as [deleted] inches in length.

That is contrasted to our present Standard missile which is 180 inches in length.

Mr. CROMWELL. The vertical launch apparently would not be adaptable to the Terrier?

Admiral MEYER. No; it would not, not the Terrier as we know it today.

We have a number of studies associated with the programs to get Terrier's performance out of a shorter missile, hence use a shorter booster and a much hotter propulsion sustainer engine; therefore, be able to get as much as [deleted] miles performance perhaps out of it.

REQUEST FOR FUNCTIONAL BREAKOUT OF R. & D. IMPROVEMENTS

Mr. CROMWELL. Would you give us a summary of the R. & D. improvement programs that are proposed in fiscal year 1978 and subsequent for the air defense missile programs?

Digitized by Google

When you give that summary, would you break that down into functional areas, that is, missile guidance, propulsion, warhead, fuse, controls and so on; and then would you show how the improved and advanced missiles will evolve from these subsystem efforts; and also would you show the funding plan, year by year, for each of those improvement programs?

Admiral MEYER. Yes, sir; I will do that to the best of my ability, recognizing this coming year we have a substantial amount of study to determine the specific answer to several of those questions you have asked.

Mr. CROMWELL. The presentations that have been given on the improvement programs are not at all cohesive and make it appear that the total R. & D. effort either is not coordinated or is not understood by the Navy.

I hope that when you provide this material you will be able to organize it a little bit better.

Admiral MEYER. All right.

[The information follows:]

Admiral MEYER. It is regrettable that the budget does not adequately depict the hardware interrelationships and commonality of the entire shipboard area defense missile family. The R&D programs for fleet air defense missiles proposed for fiscal year 1978 are in two phases, near term and far term. The near term developments are characterized by the word "Improved" and are abbreviated ERI (SM-2) and MRI (SM-1 and SM-2). The far term developments are characterized by the word "advanced" and abbreviated MRA and ERA. The improved versions are driven by the immediate threat demands and come into service during the next [deleted] years, the advanced are approximately [deleted] years hence due to the long lead for development of more significant performance. The increasing capability of the threat, changing in nature as counters are developed, requires a continuing upgrading of the missiles. The upgrading dictates confinement to Standard missile dimensions to retain logistic commonality. The costs to replace the substantial worldwide investment in handling and storage equipment and systems are very great. Further, this retains maximum adaptability to the large number of existing launching systems. Mutual development support and technical commonality provide the maximum flow of developments to all missiles in the family. In order to show what each program consists of, and how it relates to the other programs, each program will be discussed individually and in the chronological sequence in which programs will be deployed.

A. IMPROVEMENTS

1. SM2-ERI

The initial development program is SM-2 ERI and is covered under the "Propulsion Upgrade" Project. It was initiated in fiscal year 1977 [deleted]. The ERI program is the initial step towards meeting this threat. The main objective of the "Propusion Upgrade" project is to provide a rapid in-service capability against the threat through propulsion and other improvements to SM-2 ER, hence ERI. The improvements involve propulsion, control system, guidance and ordnance. Each improvement is described in order and how it accrues to subsequent missile improvements and advances.

a. *Propulsion.*—The existing ER booster has been in service since the early 1960's. It will be upgraded to use today's propellants with greater impulse. This provides the power and speed necessary for high altitude and cross range coverage. The existing booster, metal parts and fleet equipment will be retained.

b. *Control System.*—Since the missile must fly [deleted] and at higher speed, the autopilot requires modifications to provide greater stability during midcourse guidance and increase maneuverability during terminal guidance. [Deleted].

Digitized by Google

c. *Guidance.*—Modifications are made to the seeker bandwidth to reduce miss-distance in the presence of strong standoff jammers. The radome is modified slightly to withstand the temperatures of higher missile speed.

d. *Ordnance.*—Since the target and missile will both be approaching each other at higher speed, the fuze is modified to control the burst-point more accurately. The warhead is changed [deleted] to insure a target kill during the extremely short intercept encounter. Techniques developed for other missile programs are employed.

All of these improvements are being accomplished without any changes being made to the shipping, handling and launching systems, thus retaining that commonality with SM–1 and SM–2 logistics systems. This SM–2 ERI is scheduled to begin production in 1981.

2. MRI (SM–1 and SM–2)

a. SM–1

The SM–1 improvement project (MRI), a new start in fiscal year 1978, applies the benefits of the ERI program to the large number of MR capable ships (59 U.S. and Foreign now, with 74 more programed) and provides an ability to meet the growing threat.

(1) *Propulsion.*—The principal feature of MRI is to provide a new dual thrust rocket motor over the existing mid-sixties technology in a volume compatible with the existing launching systems.

(2) *Control System.*—Incorporates the ERI control system modifications into SM–1 MR production. No new design is envisioned and this modification increases production and test commonality between SM–1 and SM–2.

(3) *Guidance.*—Incorporates the ERI guidance modifications into SM–1 monopulse production and adopts the ERI radome. This provides a common guidance receiver and radome between SM–1 and SM–2.

(4) *Ordnance.*—Adopts the ERI fuze and warhead. No new development is required and will provide a common Ordnance Section.

b. SM–2

The fiscal year 1978 budget contains no request for SM–2 MRI developments nor production. However, the improvements of ERI and SM–1 MRI are directly applicable to SM–2 MR and will be incorporated as product improvements to SM–2 MR production at the appropriate time to meet ship schedules.

The SM–1 MRI is scheduled to begin production in 1982.

These "Improvement" programs provide a rapid upgrade in performance of the production ammunition for the ships which are in-service and for the low-mix ships which are programed. The SM–2 (MRI) will be available to meet early Aegis ship requirements in the event that the required MRA (described later) is not available.

B. ADVANCEMENTS

The requirement for advanced missiles evolves from two aspects: a) The threat has been growing [deleted]. b) The Aegis weapon system can provide the detection, reaction time and weapon control in this and the projected threat environment. The Aegis system matched with the SM–2 mid-course guidance provides significant improvements in range and firepower over existing weapon systems. [Deleted].

1. MRA

This project is carried as advanced medium range in the budget and is a new start in fiscal year 1978. The purpose of MRA is to provide Aegis with the missile to match its shipboard system performance and to meet the growing threat. This will be accomplished by developing advanced missile kinematics (propulsion and control) to adapt to the existing SM–2 Aegis guidance. Better launcher concepts, such as vertical launch, ease some of the size constraints imposed by existing launchers. A new standardized missile will be driven to capitalize on SM–1 and SM–2 efforts while providing the ability to meet the projected threat. Several contractors are expending several million dollars this year to define competing solutions within these constraints. As a result of propulsion upgrade studies conducted during 1976, two leading candidates have been identified: technological advancements to the Standard missile or adaptation of the Army

Digitized by Google

Patriot missile propulsion/airframe. Each approach has its advantages and disadvantages. Continued study is required to resolve the issue.

a. Propulsion.—The selection of propulsion will be based on the results of the aforementioned analysis between Standard missile advancements or Patriot.

b. Control System.—Here again, the exact configuration will result from the Standard/Patriot evaluation. It will be a direct adaptation of the ERI or Patriot control system.

c. Guidance.—Regardless of the Standard/Patriot decision, the Guidance will be the SM–2 ERI guidance (with existing AEGIS data links). (Patriot guidance is technically incompatible with AEGIS system.)

d. Ordance.—The ERI fuze will be used. The warhead will be ERI or PATRIOT as appropriate.

2. ERA

The threat is initiated from ASM launch aircraft and ships, [deleted]. It is these platforms at which ERA is aimed in the late 1980s and 1990s. [Deleted]. As the threat continues to grow in that era, the stand-off weapons such as ERA represent a diffferent approach [deleted].

The Integral Rocket Ramjet, a new start in fiscal year 1978, is oriented towards development of a [deleted] for long range. This development will be pursued under a competitive program. The technology has progressed to the point where it should now be constrained under advance development management to direct it toward meeting our requirements [deleted].

a. Propulsion.—The integral rocket ramjet has been selected as the baseline propulsion system because of its high volumetric efficiency and its ability to meet the [deleted] requirements.

b. Control System.—A new control system will be required for the IRR because of its unique propulsion and flight profile. This will be developed in conjunction with the propulsion/airframe subsystem.

c. Guidance.—A new [deleted]. It is probably that in that era, [deleted] will then be retro-fittable into MRA to provide it with improved firepower and increase production commonality.

d. Ordnance.—The ERI fuze is the baseline fuze with modifications to adapt it to the IRR airframe. A larger warhead will be developed to provide high lethality against aircraft and ship platforms.

C. SUMMARY

The air defense missile improvement programs do not create additional varieties of missiles. Rather, they are the development programs which provide our missile production lines with basic building blocks from which we can manufacture missiles with the required capability.

The evolutionary planning of the Standard area defense missile has provided steady production to meet the needs of the fleet while managing to keep ahead of the threat. Rigorous discipline in commonality has ensured that new developments such as ERI can flow into the production design of other missiles in the Standard family. This discipline has provided these benefits:

1. Logistics chaos has been prevented.

2. Rapid and orderly expansion into several kinds of missiles in several classes of ships was possible during the Vietnam War.

3. Our far-flung allies have been able to make commitments and investments, secure in the knowledge that standardization has, and will continue to, serve them.

The proposed fiscal year 1978 programs continue this long proven approach. The total fiscal year 1978 program supports the present production of Standard missiles, near term developments and longer view toward improvements to meet the threats of the next decade.

Attachments portray the phasing, commonality, adaptation and funding for the area defense missile programs.

Digitized by Google

FUNDING PROFILE AREA DEFENSE MISSILE PROGRAMS DEVELOPMENT

		1977	1978	1979	1980	1981	1982
SM-1							
MR	No RDT&E	—	—	—	—	—	—
MRI	PE 64366 Proj S0439 (SM-1 Improvements)	—	6,697	10,720	6,968	1,608	—
ER	No RDT&E	—	—	—	—	—	—
SM-2							
MR	PE 64366 Proj S0176 (STD Misl. Mid-Course Guid.)	11,869	2,075	4,831	10,138	10,160	10,160
MRI	FALLOUT from SM-1 MRI See PE 64306 Proj S0439	—	—	—	—	—	—
ER	See PE 64366 Proj S0176	—	—	—	—	—	—
ERI	PE 64366 Proj S0189 (Propulsion Upgrade)	5,000	24,518	21,440	10,879	10,881	13,058
ADVANCED							
MRA	PE 64366 Proj S0924 (Advanced Medium Range)	—	4,807	8,400	14,000	9,000	6,800
ERA	PE 6331IN Proj S0854-SH Integ. Rocket/Ramjet	—	10,468	16,133	—	—	—
	PE 6430IN Proj S0854-SH Integ. Rocket/Ramjet Eng	—	—	—	53,492	79,070	81,692

Mr. CROMWELL. Will you insert for the record the prepared material on the "Upgrade" programs.

Admiral MEYER. Yes; the statement with charts attached will be submitted.

[The information follows:]

After the SM–2 missile and CG/SM–2 completed design and nearly completed with engineering development, a new threat to the fleet was observed. This is the high altitude supersonic cruise missile launched in a heavy electronic countermeasures environment. To counter this threat, three programs are to provide for an effective defense.

CRUISER AAW IMPROVEMENT PROGRAMS

- SM-2 WARHEAD
- MISSILE PROPULSION UPGRADE
- NEW THREAT UPGRADE

Digitized by Google

[Deleted]. Terrier missile presently on our cruisers is installed in the BT version of the missile. This is a beam riding missile developed during the 1950's, which has limited range and kinematics against the high performanc target. The warhead for the SM–2 would be compatible with both the extended range and medium range versions of SM–2.

SM-2 WARHEAD

1976 ACCOMPLISHMENTS

- COMPLETED CONCEPT AND FEASIBILITY STUDIES

FY 77 PLANS

- COMMENCE ENGINEERING DEVELOPMENT

FY 78 OBJECTIVES

- COMPLETE FUZE & WARHEAD DESIGN
- COMPLETE SHIPBOARD INTEGRATION DESIGN FOR CG/SM-2.

SM-2 WARHEAD FUNDING

RDT&E	FY 77	FY 78
	.4	6.0

NEW THREAT UPGRADE (SHIP)
EXTENDED RANGE IMPROVED (MISSILE)

OBJECTIVE

"• • • USING THE CG/SM-2 BASELINE PROVIDE

CAPABILITY AGAINST DELETED THREATS • • • "

Digitized by Google

NEW THREAT UPGRADE (SHIP) EXTENDED RANGE IMPROVED (MISSILE)

Recognizing the capabilities of the [deleted] coupled with the Soviet [deleted] aircraft, the Department of Defense tasked the Navy to provide the SM-2 capable cruisers with a capability against the threat. An assessment of the CG/SM-2 capabilities and limitaitons was made in early 1976.

BASELINE
KINEMATIC INTERCEPT CAPABILITY
FOR DOWNRANGE SHIP DEFENSE (U)

DELETED

BASELINE—KINEMATIC INTERCEPT CAPABILITY

The shortcomings of Standard missile two (ER) with the Terrier system against the high altitude supersonic cruise missile launched in a heavy ECM environment and saturation type raids were identified. Due to detection limitations in ECM environment, engagement was limited to [deleted].

COMBAT SYSTEM UPGRADE

The principal improvements required in the ship system are increased detection range in the countermeasure environment and reduced reaction time. The ship system improvements are grouped into sensor, control (command), and engagement systems.

The sensor system modifications address procedural improvements and electronic countermeasures (ECM) hardening to obtain the required detection range. Procedural improvements to be initially incorporated include an integrated automatic detection and tracking system (IADT) where the AN/SPS-48C and AN/SPS-49 radar contracts are to be combined into a single composit/correlated track file to be supplied to naval tactical data systems (NTDS).

The control system modifications are oriented toward reducing reaction time and modifying the NTDS and weapon direction system (WDS) programs to accommodate the sensor system and missile improvements. The principal objective of the sensor, control, and engagement system modifications are to reduce the number of steps in the detection, processing, and engagement sequence that require operator action.

COMBAT SYSTEM UPGRADE

Modifications to the engagement systems are grouped into supporting changes in the WDS and digital fire control system (DFCS) programs, missile communication link security modifications, and fire control system ECM susceptibility.

Digitized by Google

To intercept the [deleted] missile with a projected capability to [deleted] the changes to the missile were identified as (1) propulsion improvements to achieve higher flight speeds to be accomplished by changing the propellant without increasing the rocket motor size, (2) guidance system changes to improve resistance to countermeasures and support high velocities, and (3) ordnance modifications to improve lethality against the anti-ship missile (ASM) target.

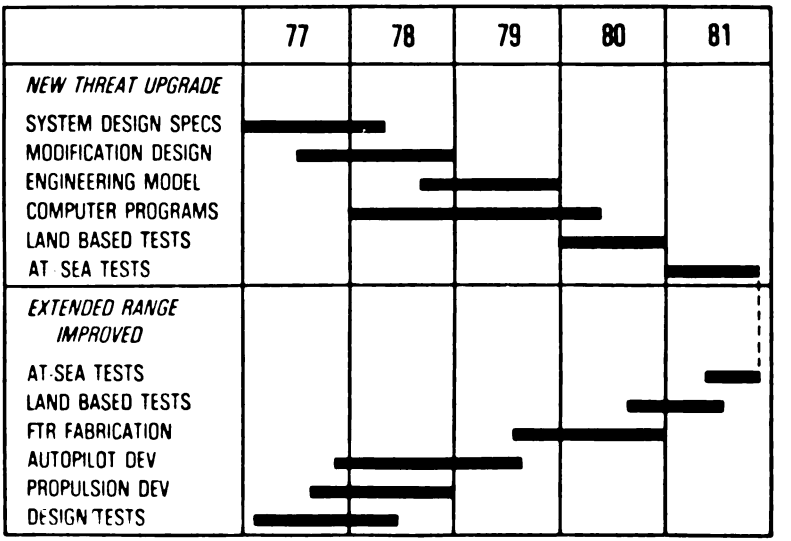
NEW THREAT UPGRADE
CG/SM-2 ER (I)
KINEMATIC INTERCEPT CAPABILITY (U)

[DELETED]

KINEMATIC INTERCEPT CAPABILITY

With these improvements, the engagement capability against [deleted] cruise missile in a heavy ECM jamming environment is significantly increased [deleted].

PROGRAM SCHEDULE



Digitized by Google

PROGRAM SCHEDULE

The program schedule for developing these changes provides for completion of at sea testing in the late fiscal year 1981.

NEW THREAT UPGRADE/EXTENDED RANGE IMPROVED SM-2
FY 77-78 RDT&E FUNDING ($M)

PROGRAM	ACTIVITIES	FY 77	FY 78
NEW THREAT UPGRADE P. E. 64352	ITT GILFILLAN, VAN NUYS, CA., ELECTRONIC COMM INC., ST PETERSBURG, FLA.	4.0	14.0
SPECS & DESIGN	APL/JHU, MD.		
EXTENDED RANGE IMPROVED P. E. 64366			
DEVELOPMENT, FABRICATION, ASSEMBLY & TEST	GD/PD, CAL., NWC/CL, CAL., NSWC/D, VA.	3.3	15.4
SUB-ASSEMBLIES (PROPULSION, ORDNANCE, TM)	ATLANTIC RESEARCH, VA., PIQUA, OHIO, NAFI, IND., MOTOROLA, ARIZ., NOS/IH, MD.	.4	3.3
TEST & EVALUATION	GD/PD, CAL., APL/JHU, MD., VITRO, MD., NSWSES, CAL.	.5	3.1
ENGINEERING SUPPORT & ANALYSIS	APL/JHU, MD., NSWC/D, VA., NSWSES, CAL.	.8	2.7
	TOTAL	9.0	38.5

FISCAL YEAR 1977–1978 R.D.T. & FUNDING

The funding required to support this program for this year and during 1978 is as shown.

NEW THREAT UPGRADE EXTENDED RANGE IMPROVED 1976 ACCOMPLISHMENTS

- STUDY COMPLETED
- BOTH TERRIER SHIP & MISSILE MODIFICATIONS DEFINED
  - NEW THREAT UPGRADE PROGRAM
  - EXTENDED RANGE IMPROVED PROGRAM

Digitized by Google

1976 Accomplishments

During 1976 the study was completed which established what areas of improvement were needed to the CG/SM-2 system to provide a capability against the [deleted] threat. Specific improvements to ship and missile systems have been defined.

NEW THREAT UPGRADE
FY 77 PLANS

- *INITIATE SYSTEM DESIGN*
  - SEARCH RADAR
  - SENSOR INTEGRATION
  - SECURE DOWN LINK
- *PREPARE SENSOR SYSTEMS SPECIFICATIONS*
- *COMMENCE SYSTEM INTERFACE DESIGN SPECIFICATIONS*

Fiscal Year 1977 Plans

During 1977 we are in the design process for the modifications to both the AN/SPS-48 three dimensional radar and the AN/SPS-48 air search radar. System design for the integrated automatic detection and tracking unit, and the communications down link between missile and ship have commenced.

NEW THREAT UPGRADE
FY 78 OBJECTIVES

- COMPLETE SENSOR SYSTEM DESIGN & SPECS
- COMPLETE SECURE DOWNLINK DESIGN
- COMPLETE NTDS PROGRAM MODIFICATION ROMTS
- COMPLETE SYSTEM INTERFACE DESIGN SPECS
- CONTINUE ENGINEERING DEVELOPMENT
- COMMENCE FABRICATION OF DEVELOPMENT MODEL

Digitized by Google

FISCAL YEAR 1978 OBJECTIVES

The fiscal year 1978 program is to complete the design and specification and commence fabrication of the development model.

SM-2 - EXTENDED RANGE IMPROVED FY 77 PLANS

- INITIATE PRIME CONTRACT
- CONDUCT WIND TUNNEL TESTING
- INITIATE PROPULSION IMPROVEMENT
- CONDUCT WARHEAD SECTION STUDIES

SM-2 FISCAL YEAR 1977 PLANS

The improvements to the missile, which involve kinematics will require wind tunnel tests, which are scheduled for this year. Efforts are underway on propellant improvements to upgrade the booster motor.

SM-2 EXTENDED RANGE IMPROVED FY 78 OBJECTIVES

- DESIGN AND DEVELOPMENT OF NEW BOOSTER
- DESIGN AND DEVELOPMENT OF BLAST TEST VEHICLES
- DESIGN AND DEVELOPMENT OF AUTO-PILOT CONTROL TEST VEHICLES
- COMPLETE WIND TUNNEL TESTING
- COMPLETE ALL SPECIFICATIONS - DESIGN FREEZE

Digitized by Google

SM-2 Fiscal Year 1978 Objectives

During fiscal year 1978 all specifications and design efforts will be completed with the improved booster being prepared for initial rocket motor tests.

This improved system will provide the required capability against the [deleted] type anti-ship cruise missile. The program as planned will have the system tested at sea by late fiscal year 1981.

Advanced Medium Range Missile

This segment of the presentation describes a program for development of an advanced medium range missile for the Aegis weapon system. This program is a new start in fiscal year 1978.

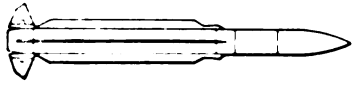
SM-1 (MR)/SM-2 Intercept Capability

One class of the threat which has been of particular concern recently is the very high altitude cruise missile which performs a maneuver to dive at the target at a [deleted] degree angle. This chart shows the areas of intercept capability of the Aegis system with SM-1 or SM-2. For this example the Aegis ship is located at the origin and the larger intercept boundary is for SM-2 with its mid-course guidance while the inner boundary is for SM-1 which has no mid-course guidance. Two threats are shown here at [deleted] foot altitudes. The bars along the trajectory are the regions of intercept. The cross-hatched bar is the region of intercept for SM-1 and the clear bars are for the SM-2. [Deleted] deficiencies in the kinematic performance of the Standard missile propulsion/airframe, limit the intercept capability [deleted] kinematic performance studies have verified this situation, and that improvement measures for the Standard missile are called for.

It is on this basis that a program has been established for development of an advanced medium range missile for Aegis. The requirement for the advanced MR is to intercept these and other threats during the cruise, maneuver and diving phase of flight.

ADVANCED MEDIUM RANGE MISSILE OPTIONS

STANDARD MISSILE VARIANT



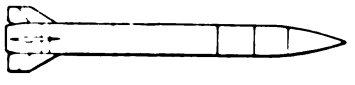
16" D – 14.75" D/186 "L – 200'L

VL/26 LAUNCHERS

CHARACTERISTICS

- BOOST/SUSTAIN, RESTART OPTION
- CLASS 7 PROPELLANT OR DAN
- SM-2 GUIDANCE & CONTROL
- INTRA-NAVY COMMONALITY
- MATURE ROCKET TECHNOLOGY (STRETCHED MOTOR)

PATRIOT MISSILE VARIANT



16" D/200" L

VL/26 MOD LAUNCHERS

CHARACTERISTICS

- BOOST COAST (12 SEC BURN)
- CLASS 2 PROPELLANT
- SM-2 GUIDANCE EXCEPT RADOME
- ARMY-NAVY COMMONALITY
- EXISTING SAM-D MOTOR

Advanced Medium Range Missile Options

During fiscal year 1976, NAVSEA conducted a missile propulsion study which examined a wide variety of options for improvement. This study included consideration of various Standard missile improvements and advancements (such as new propellants, dual area nozzles, and restartable rocket motors) longer/larger Standard missile variants, Patriot missile variants and integral rocket ramjets. These options were evaluated on the basis of kinematic performance, life-cycle-cost, logistics impact, launcher modifications and technical risk.

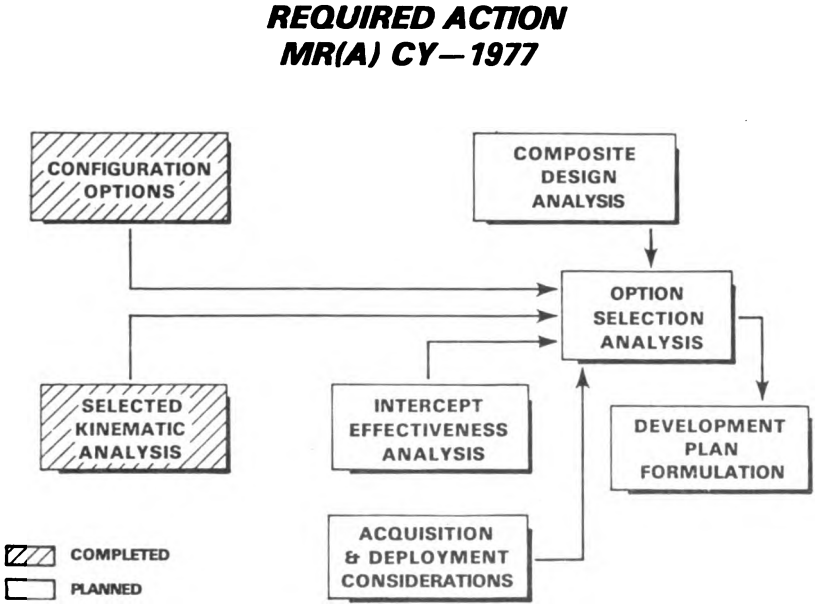
Digitized by Google

It is on the basis of these studies that we have been able to narrow the applicable options from a large number down to two. The Standard missile variant and Patriot variant have been selected as the most appropriate solutions of providing an advanced medium range missile for Aegis.

The characteristics of these two options are shown on the right side of this chart. The Standard missile variant also includes consideration of increasing the length or diameter within the constraints of the MK 26 or vertical launchers which will be used with Aegis. The Patriot variant with SM-2 guidance requires substantial modification to the MK 26 launcher and other elements of the Navy logistics cycle, but is a selected option because of its good short range performance and potential for future growth.

MR (A) SCHEDULE

The schedule for the event described in the previous chart are shown here. This covers the period of composite design analysis, intercept effectiveness studies, acquisition and deployment considerations, option selection and initiation of development.



REQUIRED ACTION MR (A) CALENDAR YEAR 1977

The procedure by which the advanced medium range missile development plan is being formulated is shown here. The configuration options and selected kinematic analysis were completed in 1976.

During 1977, efforts are taking place to complete development plan formulation. Each of the major contractors have undertaken efforts on company funding to identify the missile composite design and use this in intercept effectiveness analysis. The applied physics laboratory has undertaken efforts to define the impact of the selected options upon acquisition and deployment. Later this year, results of these studies will be used for the option selection analysis. These fiscal year 1977 efforts will permit selection of a single missile option by late calendar year 1977 and to initiate development in early fiscal year 1978 with a high degree of confidence.

Mr. CROMWELL. Bob, do you have any more?

Mr. OLD. No.

Digitized by Google

Mr. CROMWELL. Let's go into the point defense programs, and could you put into the record the 8-inch point defense, and I have two questions on the 8-inch program?

[The information follows:]

POINT DEFENSE PROGRAM REVIEWS

Gentlemen, I am Captain Mathis, the antiship missile defense project manager. We now shift our focus to point defense systems which are designed for ship self-defense (as contrasted to defense of other ships). This viewgraph depicts the point defense challenge. Those elements of the threat which are engageable at long ranges are heavily attrited by cap and the standard missile systems. However, some fraction of the threat is expected to survive these systems and must be engaged by point defense systems. In addition, the Soviet have the capability to fire anti-ship missiles from within the effective envelopes of area defense weapons systems, and these too must be engaged by point defense systems.

AAW (P) COMBAT SYSTEMS

FIRST GENERATION (PRESENT – EARLY 80's)

- 8" BATTERY
- 5" BATTERY
- TERMINAL DEFENSE BATTERY
- DECM BATTERY
- DECOY BATTERY

SECOND GENERATION (LATE 80's)

- SIRCS
- HFI

For the remainder of today's presentation we shall be discussing some of the combat systems with which we plan to equip our surface fleet for self-defense against the anti-ship missile threat. We have both near-term systems and a long-range plan. Some of the near-term systems are being installed today; others will enter full rate production in fiscal year 1978, and still others are in development with IOC's projected by 1981 or 1982. With the near-term combat systems, we find the World War II concept of weapons batteries an appropriate one. We have three "hard-kill" batteries—the 8'' and 5'' batteries being named for the diameter of their weapon, and the Phalanx CIWS terminal defense system—and there are two soft-kill systems—the decoy battery and deceptive electronic countermeasures. Today we shall discuss the hard-kill batteries and SIRCS.

Digitized by Google

AAW (POINT DEFENSE) BATTERIES

- 8" – SEA SPARROW
- 5" < ASMD MISSILE / 5" IR GUIDED PROJECTILE
- TERMINAL DEFENSE – PHALANX (CIWS)
- DECEPTIVE ELECTRONIC COUNTERMEASURES (DECM)
  < WLR-8/SLQ-17 / ASMD EW 3
- DECOY { WLR-8 / ASMD EW } + DECOYS

This viewgraph depicts the make-up of the near-term AAW batteries. The 8'' battery utilizes a surface-launched version of the Sparrow missile as its weapon. It is the longest range and in many respects the most capable weapon system. It is also the most expensive. This 5'' battery could be either 5'' IR guided projectiles on ships with 5'' guns, or the 5'' ASMD missile system. Only the ASMD missile system will be discussed today. The final hard kill system is the Phalanx CIWS, intended as the last ditch defense for almost every ship in the fleet.

DESIGN FEATURES OF AAW (P) BATTERIES

- MODULAR DETECTION THROUGH DEFEAT SYSTEMS
- DEFENSE IN DEPTH
- AFFORDABLE COMBINATION AVAILABLE FOR EVERY SHIP
- EACH BATTERY UTILIZES DIFFERENT TECHNOLOGY
  - COMPLEMENTARY
    - WEAKNESS IN ONE COMPENSATED BY STRENGTHS IN OTHERS

A significant feature of each of these batteries is that they are being engineered as detection through engagement combat system, capable of being installed in each class of ships in the numbers and combinations which will meet the threats each class of ship is expected to meet. They offer the option of defense in depth, from [deleted] range of the Sea Sparrow to the [deleted] effective range

88-379 O - 77 - 25

Digitized by Google

of ASMD missile to the very close-in kill of the Phalanx. With Phalanx costing well under half the cost of the 8" battery, and the cost of the 5" batteries a fraction of Phalanx costs, these batteries will make available an affordable combination of systems for each class of ships. Finally, each battery uses a different technology to defeat the threat. The 8" system uses, a semi-active homing missile. The 5" weapons use IR terminal guidance, the CIWS is a radar-directed gun. The decoy will be chaff, IR flares or other IR and RF decoys, and the DECM battery utilizes electronic deception. Thus, an enemy missile designer has a nearly impossible countermeasures task. Further we find that limitations in one of our systems can be compensated by strengths in others. For example, Sea Sparrow systems can engage only one or two threats simultaneously (one per missile fire control radar) and are magazine limited to 8 missiles. If the ASMD missile is added to the system via inserts in the Sea Sparrow launchers, we believe we'll be able to put 10 ASMD missiles in place of 2 Sparrow missiles, effectively doubling the magazine capacity. Further, for those threats which it can engage, the ASMD missile system is not constrained to one engagement per fire control radar, and thus the combined system would be able to engage a larger number closely spaced threats.

This viewgraph notes one proposed allocation of AAW batteries. Decisions on AAW armament are reviewed frequently in the light of fiscal constraints and later analytical data or other weaponizing decisions, but this does capture the flexibility of this approach. The 8" batteries are in place or being installed now and the installation pace accelerates in the budget period. The 5" batteries will continue in development, and the Phalanx 20-mm CIWS will commence production in FY-1978. The decoy and DECM batteries, i.e., ASMD EW and SRBOC will also be in production in FY-1978.

I will now be followed by the project managers for those hard-kill weapons under your committee's cognizance.

8" MISSILE FUNDING SUMMARY

The 8" missile funding summary line is the total of funds for the basic and improved point defense surface missile systems—the 8" battery.

8" BATTERY

DETAILED FUNDING SUMMARY ($\overline{M}$)

	FY 1977	FY 1978
RDT&E	9.8	7.8
AN/SPS-58, 64508N, S0166-AA	.3	.3
TARGET ACQUISITION SYSTEMS, 64362N, S0174-AA	3.6	.9
RIM-7F, 64361N, S0173-AA	5.9	6.4
OPN	5.5	23.6
BASIC POINT DEFENSE, P-1, 254, BA-4	.8	1.9
AN/SPS-58, P-1 60 BA-2	4.7	7.0
TARGET ACQUISITION SYSTEMS, P-1 61, BA-2	0	15.6
OMN	5.7	6.4
BASIC POINT DEFENSE	3.5	3.9
AN/SPS 58	.2	.2
NATO SEASPARROW	2.0	2.3
TOTAL	21.0	37.6

Digitized by Google

8'' MISSILE DETAILED FUNDING SUMMARY

The total 8'' missile funding is summarized here by appropriation and project. The increase over FY 1977 FOP FY 1978 is due primarily to the start of production of the target acquisition system.

SEASPARROW MISSILE SYSTEMS EVOLUTION

Gentleman, I am Captain Mathis, manager for the two 8'' Seasparrow surface missile systems which are called basic point defense and improved point defense. I also manage the 5'' ASMD missile system which will be presented following the 8'' systems.

The 8'' Seasparrow missile systems have evolved from a 1966 requirement to rapidly develop a point defense system, making maximum use of off-the-shelf components and existing equipments while relying on visual acquisition. This requirement was met two years later by fleet introduction of the manually operated basic point defense system which used a surface adaptation of the air-to-air AIM–7E Sparrow missile. To this system was added the SPS–58 search and acquisition radar in 1970. This radar is presently being upgraded to improve performance and is now called the SPS–65. This basic point defense system is in the fleet today.

Also in 1966 an advanced point defense study was completed which defined an automatic, rapid reaction, multi-mode point defense missile system to cope with the projected threat of the 1970/1980s. This concept evolved into the NATO Seasparrow surface missile system and the target acquisition system. As for the missile, limited dual guidance mode development was conducted, but again, a surface adaptation of the air-to-air AIM–7E Sparrow missile was used. The NATO Seasparrow system has been in production since 1973 and is now in our Navy, as well as NATO navies. The target acquisition system is planned to start production in fiscal year 1978. An upgrade of the system's missile is presently underway, adapting the new air-to-air AIM–7F Sparrow for surface use. Upon delivery of the target acquisition system (with its pulse doppler search radar) and the RIM–7F Seasparrow missile to the fleet, the improved point defense surface missile system will be operational.

BPD SHIP INSTALLATIONS

Summarizing fleet basic point defense systems—by the end of fiscal year 1978, the Navy objective is that five classes of ships—CV, FF–1052, LPH, LCC and LHA—will have 67 systems on board. As shown for fiscal year 1979 and out, aircraft carriers will receive the more capable NATO Seasparrow system, which will cause a decrease in total basic point defense systems in the fleet.

BPD PICTURE

The basic point defense surface missile system is represented here in the ultimate FF–1052 class configuration—the radar at the top and the missile system along the right side.

ACCOMPLISHMENTS—1976

Accomplishments in the basic point defense surface missile system this past year included installing two radars in the U.S.S. *Kansas City* (AOR–3) and *Blue Ridge* (LCC–19). Radar installations commenced in U.S.S. *Detroit* (AOE–4), *Inchon* (LPH–12), *Sacramento* (AOE–1), *Roanoke* (AOE–7) and *Camden* (AOE–2). One basic point defense system was installed in U.S.S. *Tarawa* (LHA–1) and one basic point defense system installation commenced in U.S.S. *Vreeland* (FF–1068). For the upgrade program, two fire control interface groups were procured. Operational support documentation was issued for the AN/SPS–58 series radars and support to the fleet was provided to 46 ships.

FISCAL YEAR 1977 PLANS

Basic point defense surface missile system plans for the remainder of fiscal year 1977 include installing five radars in the *Detroit*, *Inchon*, *Sacramento*, *Roanoke*, and *Camden*. Radar installations will commence in U.S.S. *Iwo Jima* (LPH–2) and U.S.S. *Okinawa* (LPH–3). One basic point defense system will

Digitized by Google

complete installation in U.S.S. *Vreeland* (FF–1068) and three basic point defense installations will commence in U.S.S. *Eisenhower* (CVN–69), U.S.S. *Saipan* (LHA–2) and U.S.S. *Patterson* (FF–1061). For the upgrade program, 14 radars and 20 fire control interface groups will be procured. During fiscal year 1977, support to the fleet is being provided to 51 ships.

OBJECTIVES—FISCAL YEAR 1978

Basic point defense surface missile system objectives for fiscal year 1978 include completing installation of two radars in U.S.S. *Iwo Jima* and *Okinawa*, and three basic point defense systems in U.S.S. *Eisenhowever*, *Saipan* and *Patterson*. Radar installations will commence in U.S.S. *Meyerkord* (FF–1058), U.S.S. *Connole* (FF–1056), U.S.S. *Bagley* (FF–1069), U.S.S. *Hepburn* (FF–1054). One basic point defense system deinstallation will commence in U.S.S. *Independence* (CV–62) in order to install the NATO Seasparrow surface missile system. Sixteen radars, nine upgrade kits and 15 fire control interface groups will be procured. Upgrade radar support documentation and maintenance training will become available while providing fleet support to 55 ships.

FUNDING

The basic point defense missile system is out of production but the search radars are being procured. Funding for the basic point defense surface missile system is primarily related to support of the fleet.

IMPROVED POINT DEFENSE SURFACE MISSILE SYSTEM

The increasingly sophisticated threat of the late 1970s and 1980 ERA require the Navy to improve its point defense beyond the basic point defense surface missile system. One improvement, properly named the improved point defense surface missile system, consists of the target acquisition system planned to commence production in fiscal year 1978, the NATO Seasparrow surface missile system introduced in our fleet last year, and the RIM–7F missile now in development as a surface adaptation of the air-to-air AIM–7F Sparrow missile.

8'' SYSTEM PICTURE

This photograph is of the 8'' NATO Seasparrow system in the U.S.S. *Roanoke* (AOR–7). The launcher is centerline and AFT of the dual directors.

ACCOMPLISHMENTS—1976

Accomplishments in the improved point defense surface missile system this past year included installing three NATO Seasparrow missile systems in U.S.S. *Kansas City* (AOR–3) and at the two training facilities in Virginia and California. NATO Seasparrow system installations commenced on U.S.S. *Sacramento* (AOE–1), U.S.S. *Detroit* (AOE–4), U.S.S. *Roanoke* (AOE–7), U.S.S. *Kitty Hawk* (CV–63) (two systems), U.S.S. *Spruance* (DD–963) and U.S.S. *Foster* (DD–964).

At-sea testing of equipments in the improved point defense surface missile system was particularly successful this past year with the target acquisition system passing both its Navy technical evaluation and its Navy operational evaluation on board U.S.S. *Downes* (FF–1070), system qualification tests for the NATO Seasparrow system on board U.S.S. *Kansas City* (AOR–3) culminated in four successes in four missile firings. The RIM–7F missile contractor demonstration tests were conducted last fall on board U.S.S. *Downes* (FF–1070) with four successes out of six valid flights.

FISCAL YEAR 1977 PLANS

Expected accomplishments in the improved point defense surface missile system for the remainder of fiscal year 1977 include completing the seven NATO Seasparrow installations commenced in calendar year 1976 and commence installations in U.S.S. *Camden* (AOE–2), U.S.S. *Ranger* (CV–61) (two systems), U.S.S. *Kincaid* (DD–965), U.S.S. *Hewitt* (DD–966), U.S.S. *Elliot* (DD–967), U.S.S. *Radford* (DD–968), U.S.S. *Peterson* (DD–969) and U.S.S. *Downes* (FF–1070). The target acquisition system is expected to be approved for service

Digitized by Google

use. Navy technical evaluation of the RIM–7F missile will be conducted this summer with 10 missile firings from U.S.S. *Kansas City* (AOR–3) in August and September.

OBJECTIVES—FISCAL YEAR 1978

Improved point defense surface missile system objectives for fiscal year 1978 including completing installation of the nine NATO Seasparrow missile systems started in fiscal year 1977 and commencing 13 NATO Seasparrow missile system installations in U.S.S. *Independence* (CV–62) (two systems), *Caron* (DD–970), *Ray* (DD–971), *Oldendorf* (DD–972), *Young* (DD–973), *Comte de Grasse* (DD–974), *O'Brien* (DD–975), *Merrill* (DD–976), *Briscoe* (DD–977), *Stump* (DD–978), *Connolly* (DD–979) and *Mooserugger* (DD–980). The production contract is planned for three target acquisitions systems, ultimately bound for U.S.S. *Foster* (DD–964), U.S.S. *Seattle* (AOE–3) and the California training site; production start-up, tooling and test equipments are included in this first contract. Thirty forward-fit RIM—F7 prototype missiles are planned for procurement for the Navy operational evaluation.

IMPROVED POINT DEFENSE SHIP INSTALLATIONS

Summarizing NATO Seasparrow missile systems in the U.S. Navy, the objective is that 15 ships—2 CV, 3 AOE, 2 AOR, 7 DD–963 and 1 FF–1052—will have 17 systems on board by the end of fiscal year 1978. As shown for 1979 and out, a total of 48 ships and 2 training sites are planned for this system.

RIM–7F DEVELOPMENT SCHEDULE

This Vu-graph shows the RIM–7F block I and associated NATO Seasparrow ship system modifications development schedule.

The CDT was completed in September 1976 in firings from U.S.S. *Downes*, on schedule and within cost.

The NTE will be conducted from the U.S.S. *Kansas City* (AOR–3) in late fiscal year 1977. The OPEVAL will be conducted in late fiscal year 1979.

(C) This will result in an [deleted].

FUNDING—IPD

The funding profile for improved point defense surface missile system is the same as the systems which comprise it: Missile and system upgrades in current development status are shown in the RDT&E line, target acquisition system procurements are shown in the OPN line and NATO Seasparrow missile system support requirements are shown in the O. & M.N. line.

NATO SEA SPARROW

Mr. CROMWELL. The NATO Sea Sparrow missile has an IOC of [deleted] 1 year later than the IOC of the improved monopulse version of the Sparrow missile.

Why shouldn't the NATO Sea Sparrow program be terminated and the R. & D. funding concentrated on the ship version of the monopulse missile?

Admiral MEYER. I have with me Captain Ron Mathis, who is the manager for that effort.

Captain MATHIS. Mr. Chairman, it is our intention upon the successful DSARC II decision this fall, with the Naval Air Systems Command, who is the prime developer of monopulse, that the surface Navy will take its NATO Sea Sparrow program, its RIM–7F of development, out of the conical scan seeker and merge it with the monopulse, as we refer to it, the Block II schedule.

Mr. CROMWELL. What is the cost impact of changing from the conical scan to the monopulse program?

Digitized by Google

Captain MATHIS. It will be $2.1 million additional in fiscal year 1978.

Mr. CROMWELL. $2.1 million required?

Captain MATHIS. Of total?

Mr. CROMWELL. Required in fiscal year 1978.

Captain MATHIS. Yes, sir.

Mr. CROMWELL. What is the budget request?

Captain MATHIS. The request before the Congress is for $6.4 million. A request within Navy apportionment has been made for $2.1 million also.

INTEGRAL ROCKET RAMJET PROGRAM

Mr. CROMWELL. I missed a couple of questions here. I think they apply to the long-range missile, the air missiles.

What is the fiscal year 1979 funding for the integral rocket ramjet program and also the 5-year defense plan year-by-year funding?

Admiral MEYER. There is $10.5 million in 1978 for the integral rocket ramjet; $5.7 million of that is devoted to propulsion and airframe work, $2.9 million devoted to guidance and ordnance, and $1.9 million devoted to targeting studies and the combat systems support.

I do not have with me the overall program. I would have to provide that to you.

Mr. CROMWELL. Could you provide that?

Admiral MEYER. Yes, sir.

[The information follows:]

Admiral MEYER. The 5-year defense plan for IRR:

	Thousands
Fiscal year 1978:	
P.E. 63311N IRR	10,468
P.E. 64301N IRR ENG	—
Fiscal year 1979:	
P.E. 63311N IRR	*16,133
P.E. 64301N IRR ENG	—
Fiscal year 1980:	
P.E. 63311N IRR	—
P.E. 64301N IRR ENG	*53,429
Fiscal year 1981:	
P.E. 63311N IRR	—
P.E. 64301N IRR ENG	*79,070
Fiscal year 1982:	
63311N IRR	—
63311N IRRENG	*81,092

*Planning numbers only subject to alteration by the POM process.

Mr. CROMWELL. Is it the start of a completely new missile program?

Admiral MEYER. No; it is the amalgamation of the various efforts that have gone on for a decade now throughout the country in the development of technology related to ramjets and to solid rocketry, and we are now trying to focus that into a cohesive engineering development program to produce a new "Standard Missile" to be used in the next decade.

Mr. CROMWELL. Is there an IOC envisioned for the missile?

Admiral MEYER. I believe it would be premature to answer that.

Mr. CROMWELL. Does that mean no?

Admiral MEYER. Yes. Our studies this year are to determine—are to hang a calendar on that. Ten years would be my guess.

Digitized by Google

[The information follows:]

Admiral MEYER. No. Sufficient money could provide an IOC as early as 1986–7. In my personal opinion the technical risks and fiscal realities make an IOC earlier than 10 years questionable.

Mr. CROMWELL. We will insert the Advanced Programs statement in the record at this point.

[The statement follows:]

ADVANCED PROGRAMS
DETAILED FUNDING SUMMARY ($\overline{M}$)

			FY 77	FY 78
RDT&E			1.0	1.0
	PE	*PROJ NO*		
IRR	63311N	S0854-SH	0	10.5
AREA SAM TECH	63318N	S0186-AA	1.0	4.0
TOTAL			1.0	14.5

DEFENSE SYSTEM CHARACTERISTICS REQUIRED

The requirements for system response in each region are shown.

These become system design goals and drive the nature of our development programs.

Note that the requirements are significant in the several regions.

Earlier surface missile development programs discussed have emphasized response in zones A and B. The program we are presenting here for an advanced extended range missile has its primary emphasis in zones C and D.

TODAYS RESPONSE

Todays response covers only region A by shipboard defenses and this is for nonsevere attacks.

The carrier aircraft provide defense at longer ranges.

In heavy countermeasures or without carrier aircraft our response in zones C and D is where we need to improve.

REQUIRED RESPONSE

We have to solve the problem piecemeal—by dividing into engagement regions the different targets to be engaged in the various regions are shown: Regions A and B, emphasize missile tragets; Regions C and D, emphasize ships, aircraft and submarines which launch antiship missiles or support attacks with command and control or jamming.

INTEGRAL ROCKET RAMJET MISSION

The mission of the integral rocket ramjet is to accomplish long range destruction of energy [deleted] platforms. The destruction of air platforms will negate the enemy's ability to detect and jam our forces, and disrupt his ability to accomplish command and control of his own forces. Surface platform kills will reduce the utilization of nuclear ASM's against our forces, a situation in which one penetrator is too many. Destruction of antiship missiles at medium to long range [deleted] will increase effectiveness of fleet point defense weapons by greatly reducing the number of leakers to be engaged.

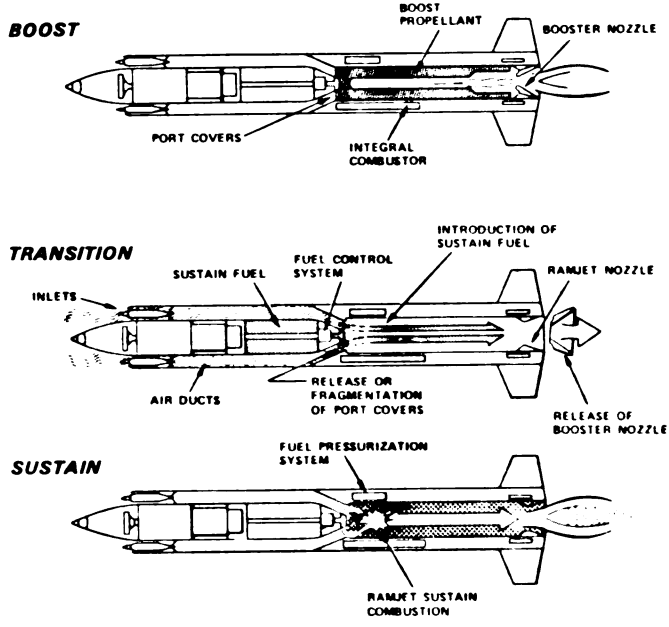
Digitized by Google

BENEFITS OF L. R. ENGAGEMENT

In a task force operation, an advanced extended range missile can provide increased levels of defense by destroying long range air and surface targets. With fewer jammers to deal with, CAP control will be restored. The jamming environment for our medium and short range defense systems will be reduced significantly, and simultaneous high arrival rates of threats to the task force will decrease.

Independent operations will be enhanced due to the reduction of enemy ASM Launching capability. The reduction of ASM launches will make it more difficult for the enemy to mount and coordinate a saturation attack on a single ship, allowing the ship to maintain its sea control function in higher threat density environment.

INTEGRAL ROCKET—RAMJET (IRR) PROPULSION CONCEPT



IRR PROPULSION CONCEPT

The Integral-Rocket Ramjet propulsion concept, which employs the booster propellant internal to the Ramjet combustion chamber, differs from the operational Talos missile which employed a separable solid propellant booster unit. This integral booster concept allows for increased propulsion volumetric efficiency, wherein a vehicle one-third the volume of a Talos missile can achieve the same range but at higher speed, and with high altitude capability. Reduced missile volume can then lead to more flexibility of employment with different launching systems, especially newly-introduced vertical launching techniques.

REQUIRED CHARACTERISTICS

An advanced extended range missile system must be supported by very capable sensing and coordination systems to utilize its full potential, reliable over-the-horizon targeting and the coordination of available task force links are important to the successful utilization of the new missiles full potential.

Digitized by Google

The missile itself must possess supersonic long-range flyout capability, with multiple guidance techniques to respond to different threats, and increased ordnance lethality to destroy [deleted] platforms.

DEVELOPMENT APPROACH

Although the Integral-Rocket Propulsion scheme appears most attractive at this time, an exhaustive consideration of alternatives is being undertaken to ensure that the selected configuration of an extended range missile will be technically and economically prudent. To this end, selected exploratory development (category 6.2) and prototyping (category 6.3) programs are being directed to support the requirements for such a weapon.

The weapon system elements needed to employ this advanced missile are ongoing to a great extent; these efforts will be monitored and updated with appropriate IRR requirements as they become available.

DEVELOPMENT PLAN

The development plan stresses a competitive industry involvement for as long as practical. During the conceptual phase, industry-funded studies will contribute to program planning activities as well as to technical trade-offs. Additionally, the exploratory and advanced development programs listed will support the technology developments needed for the advanced range missile.

Competition will be maintained through the validation phase to foster technical and economic trade-offs which will benefit the Government. Funded programs as well as unfunded Nicrad studies will contribute to the overall weapon system development as the missile system takes shape in advanced development.

IRR FISCAL YEAR 77 ACTIVITY

Up to this point, preliminary program documents have been prepared and are being staffed. The mission need statement and plan of action of milestones documents will set the framework within which the planned fiscal year 1977 activities will operate.

A 3 March 1977 industry briefing is scheduled to solicit participation in early program planning and technical trade-offs prior to the receipt of funding in fiscal year 1978. Coordination of category 6.2/6.3 programs will continue in an effort to solidify IRR requirements with these technology developments and prepare for initiation of development in fiscal year 1978.

INTEGRAL ROCKET RAMJET FY 78 OBJECTIVES

- CONDUCT TRADE-OFFS OF MISSILE/MISSION REQUIREMENTS
- INITIATE CONTRACTS FOR COMPETITIVE PROPULSION/AIRFRAME DESIGNS
- INITIATE MULTIMODE GUIDANCE & ORDNANCE DESIGN
- IDENTIFY IRR COMBAT SYSTEM DESIGN REQUIREMENTS FOR ONGOING AND NEW DEVELOPMENTS

Digitized by Google

IRR FISCAL YEAR 78 OBJECTIVES

In fiscal year 1978, funded efforts will be directed to conduct mission tradeoffs, initiate competitve propulsion system and guidance and ordnance system designs, and to identify IRR combat system design parameters for on-going and new development. These funded tasks will be driven by the earlier unfunded studies mentioned previously, which set up the groundrules for the more hardware-oriented decisions which will follow in fiscal year 1978.

INTEGRAL ROCKET RAMJET
FY 78 RDT&E FUNDING ($M)
P. E. 63311 PROJ. S0854

TASKS	ACTIVITIES	FY 78 $M
PROPULSION/AIRFRAME DESIGN	APL/JHU, LAUREL, MD. NWC, CHINA LAKE, CA. CONTRACTORS, TBD	5.7
MULTIMODE GUIDANCE ORDNANCE DESIGN	NSWC, DAHLGREN, VA. NWC, CHINA LAKE, CA. APL/JHU, LAUREL, MD. CONTRACTORS, TBD	2.9
COMBAT SYSTEM DESIGN	NELC, SAN DIEGO, CA. APL/JHU, LAUREL, MD. NSWC, DAHLGREN, VA.	1.9

IRR FISCAL YEAR FUNDING

The funding cited here reflects the relative maturity of the technology base available for the program. Propulsion system manufacturers are well aware of the requirements for an IRR type design, and guidance, ordance, and ship system options are being defined now. Therefore, about one-half of the available fiscal year 1978 funds will be devoted to the assessment of these options, critical experiments and selection of appropriate alternatives.

Digitized by Google

ARMY/NAVY AREA DEFENSE SAM TECHNOLOGY PROGRAM ELEMENT 63318N

ARMY/NAVY AREA SAM

RDT&E FUNDING ($M)

P.E. 63318N

PROJECT	ACTIVITIES	FY 77		FY 78	
		NAVY	ARMY	NAVY	ARMY
ADVANCED SURFACE-TO-AIR RAMJET	APL/JHU LAUREL, MD. ABL/HERCULES, CUMBERLAND, MD. BENDIX/ASD, MISHAWAKA, IN.	.8	.1	.7	0
ALTERNATIVE ANTENNA ARRAYS	CONTRACTOR TBD	.1	1.1	1.5	1.1
MULTIMODE GUIDANCE	APL/JHU LAUREL, MD. CONTRACTOR TBD	.1	.3	1.6	3.1
OUT YEAR NEW STARTS	TBD			.2	.8
TOTALS		1.0	1.5	4.0	5.0

ARMY/NAVY AREA SAM PROGRAM OBJECTIVES

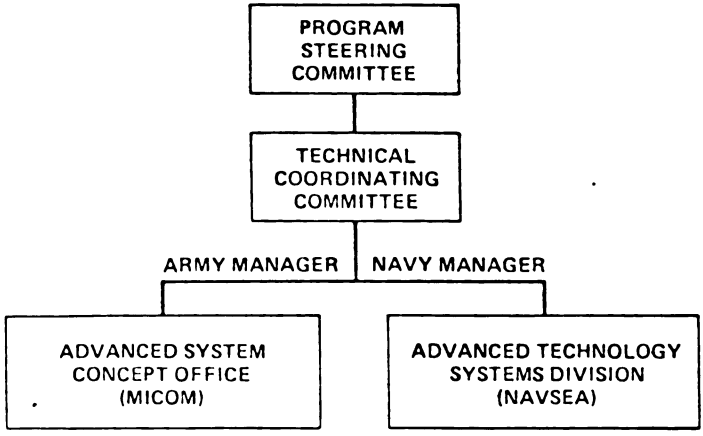
1. FOSTER COMMONALITY IN FUTURE MISSILE SYSTEMS
2. AVOID UNNECESSARY REDUNDANCY IN DEVELOPMENT EFFORTS
3. REDUCE DEVELOPMENT COST, TIME, AND RISK USING "PROTOTYPING" APPROACH
4. PROMOTE MODULAR MISSILE DESIGNS WHERE PRACTICAL
5. EXPLOIT TECHNOLOGY ADVANCES/BREAKTHROUGHS

Digitized by Google

ARMY/NAVY AREA SAM PROTOTYPE PHILOSOPHY

- PROOF OF PRINCIPLE HARDWARE DEMONSTRATION
- FLEXIBILITY (CONTRACTS, SCHEDULES, ETC)
- USE OF CONTRACTOR DRAWING/REPORTING FORMAT
- SMALL PROGRAM MANAGEMENT TEAMS

ARMY/NAVY AREA SAM BISERVICE MANAGEMENT



ARMY/NAVY AREA SAM

ADVANCED SURFACE-TO-AIR RAMJET (ASAR)

OBJECTIVE:

GROUND TEST DEMONSTRATION OF FLIGHTWEIGHT INTEGRAL ROCKET RAMJET PROPULSION SYSTEM

FY 77 MILESTONES:

PROPULSION DESIGN COMPLETED

FABRICATION OF PROTOTYPE HARDWARE

STATIC BOOSTER MOTOR TESTS (2)

HIGH ALTITUDE RAMJET SUSTAINER TESTS (2)

Digitized by Google

ARMY/NAVY AREA SAM

FY 77 PROTOTYPE PROJECTS

- ADVANCED SURFACE-TO-AIR RAMJET (ASAR)
- ALTERNATIVE ANTENNA ARRAYS
- MULTIMODE GUIDANCE

ASAR INTERIOR PLANFORM WITH TVC NOZZLE (U)

[COMPLETED]

ARMY/NAVY AREA SAM

ALTERNATIVE ANTENNA ARRAYS

OBJECTIVE:

DESIGN, FABRICATE AND TEST LIGHT WEIGHT, LOW COST ARRAYS FOR PATRIOT (C-BAND) AND AEGIS (S-BAND)

FY 77 MILESTONES:

ARMY/NAVY MEMORANDUM OF AGREEMENT APPROVED

DETAILED SPECIFICATIONS PREPARED

COMPETITIVE PROCUREMENT/CONTRACT AWARD

Digitized by Google

ARMY/NAVY AREA SAM

MULTIMODE GUIDANCE

OBJECTIVE:

DEMONSTRATE ADVANCED MULTIMODE GUIDANCE TECHNIQUES FOR FUTURE ARMY/NAVY AREA DEFENSE MISSILES

FY 77 MILESTONES:

ARMY/NAVY TECHNICAL TEAMS ESTABLISHED

DEVELOPMENT OF PROGRAM TECHNICAL REQUIREMENT

ARMY/NAVY MEMORANDUM OF AGREEMENT

ARMY/NAVY AREA SAM

FY 78 PLANS

- ADVANCED SURFACE-TO-AIR RAMJET:
  - SEA LEVEL TRANSITION TESTS (2)
  - COMPLETE BOOST/TRANSITION/SUSTAIN TESTS
- ALTERNATIVE ANTENNA ARRAYS:
  - SUBARRAY DUPLEXER DEVELOPMENT
  - ANTENNA/RADOME DESIGN
  - BEGIN FABRICATION
- MULTIMODE GUIDANCE:
  - INITIATE COMPETITIVE PROCUREMENT
  - CONTRACT AWARD
- SOLICIT/PROPOSE NEW PROTOTYPE PROJECTS

ARMY/NAVY SAM TECHNOLOGY

Mr. CROMWELL. For the Army/Navy SAM program, how much of the fiscal year 1977 funding of $1 million currently is released by OSD and is on contract?

Admiral MEYER. I can't answer that.

Mr. CROMWELL. Provide that for the record.

[The information follows:]

$1 million of the Army/Navy SAM Technology fiscal year 1977 funds have been released; $0.8 million is currently on contract.

Digitized by Google

TAS PROGRAM STATUS

Mr. CROMWELL. Back to the point defense area, is the TAS system going into procurement in fiscal year 1978?

Captain MATHIS. Yes, sir.

Mr. CROMWELL. Could you provide a summary for the record of the development status of the TAS procurement plan and procurement funding profile?

Captain MATHIS. Yes, sir.

Admiral MEYER. Yes, sir, we can.

[The information follows:]

Planning for the procurement of the MK 23 Target Acquisition System is contained in Navsea Advance Procurement Plan No. 164–77 which was approved by the Chief of Naval Material on 28 January 1977. The key milestones leading to award of the initial production contract (FY 78) are summarized below:

Approved Advance Procurement Plan, January 1977.
RAN and D&F Approval—June 1977.
Issue Request for Proposal—June 1977.
Receive Proposal—July 1977.
Complete Negotiation—September 1977.
Award Contract—October 1977.
To date, actions required are on schedule.
The procurement funding profile is shown below:

	Millions
Fiscal year 1978	15.6
Fiscal year 1979	19.3
Fiscal year 1980	26.5
Fiscal year 1981	23.0
Fiscal year 1982	6.4

The dollars are expected to cover procurement in numbers as follows:

	Millions
Fiscal year 1978	3
Fiscal year 1979	9
Fiscal year 1980	14
Fiscal year 1981	12
Fiscal year 1982	3

Mr. CROMWELL. We will go in to the Vulcan/Phalanx and put it in the record.

Admiral MEYER. Yes, sir.

VULCAN-PHALANX PROGRAM REVIEW

[Statement of Commander Meinig follows:]

PHALANX CLOSE-IN WEAPON SYSTEM (CIWS)

Phalanx close-in weapon system is a terminal anti-ship missile defense system intended both as a stand-alone weapon in ships without other defensive armament, and as a complement to defense provided by aircraft and missile systems. The fully automatic Phalanx incorporates search and tracking radars, a digital fire control system, and a 20mm, 3000 round per minute Gatling gun. With an operationally demonstrated reaction time of less than [deleted] from target detection to open fire, the system provides high-confidence last-ditch, automatic protection against missiles which otherwise would almost certainly hit the ship.

Navy is requesting $74.9M in weapon production funding for the fleet Phalanx units. Navy is also requesting $6.9M in RDT&E.

During 1976, Phalanx lethality against a dynamic, threat-representative missile was conclusively demonstrated, and Navy was authorized to proceed with fabrication of an operational suitability model (OSM). That system has now

Digitized by Google

been completed and is installed in USS Bigelow (DD–942) for technical testing through April 1977 and for operational evaluation May to June 1977. System reliability has been excellent and system maintenance by Navy technicians has been satisfactorily performed. Test results to date have been outstanding.

Concurrently, prototype 1, employing the same computer program as the OSM, has been successfully tested at San Nicholas Island in the Pacific missile range against [deelted] fired by a Navy ship offshore. [Deleted.]

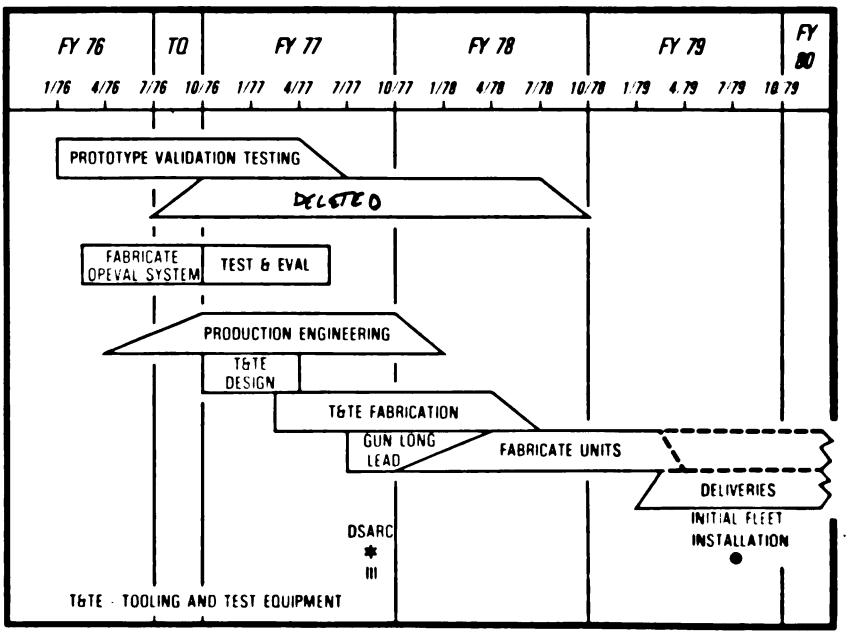
The 1977 milestones for Phalanx will evolve from completion of technical and operational evaluation in June, and incorporate those approvals and decisions necessary to enter into an initial production contract.

The principal goal in fiscal year 1978 will be the production start for an initial delivery o f23 fleet Phalanx units. These weapons, which would be installed in 1979 and 1980, will provide [deleted] anti-ship missile defense [deleted]. This is the first year of a [deleted] production program now planned to provide [deleted] Phalanx systems to [deleted] ships.

The fiscal year 1978 RDT & E is to be used primarily to complete design, fabrication, proofing, test and evaluation of the Phalanx production configuration. Program efforts also include completion of testing [deleted] and commencement of a development program [deleted].

The production effort is primarily distributed between General Dynamics, Pomona, VA, the prime contractor, and General Electric, Burlington, VT and Pittsfield, MA, the major sub-contractors. Engineering services are provided by several Navy activities.

PHALANX SCHEDULE



The Phalanx program is proceeding on the same schedule as was briefed to the Congress during last year's hearings.

Digitized by Google

In summary, Phalanx has matured through a long development effort and exhaustive testing into a system ready for final evaluation and subsequent transition into production. A DSARC III production decision and approval for service use in August 1977 will result in a first production contract about November 1977. An initial operational capability (IOC) for 1979 is planned.

PRODUCTION SCHEDULE

Mr. CROMWELL. Why is the 22-month delivery schedule being proposed in fiscal year 1978 instead of 12 months funded delivery period?

Admiral MEYER. I have Commander George Meining here.

Commander MEINIG. Mr. Cromwell, the reason that we are planning for a delivery period in excess of 12 months for the first production buy is to eliminate the recurring necessity for long lead procurements in subsequent buys, while at the same time satisfying the Navy's need for delivery of systems at the earliest time.

Mr. CROMWELL. How much would be required in fiscal year 1978 to fund only the first 12-month production program, and then with long lead provided for fiscal year 1979, keeping the total production on the presently proposed schedule?

Commander MEINIG. For the WPN units in a plan that would provide delivery over the 12 months, we would be looking at a net decrease of about $8.5 million, which would be offset by the requirements for additional long lead in anticipation of the fiscal year 1979 buy, such that the total difference between the existing proposed plan—the budget plan—and cutting it to 12 months by slipping five units into the following year would be aproximately $5.82 million. This would be offset again by the necessity of showing the higher unit cost per system in the SCN accounts that require moneys for Phalanx this year, so that the actual difference with the revised schedule would be an increase of $0.6 million, if we would cut the number of units this year.

Mr. CROMWELL. Would you provide the same information for the SCN funded systems?

Commander MEINIG. Yes, sir. The SCN funded systems requesting Phalanx funding in fiscal year 1978, are the FFG, DDG–47 and the AO programs. The required increase would be from $44.46 million to $49.25 million. That, again, is because of the higher unit cost introduced by the reduction in total numbers of units, sir.

WEIGHT OF CIWS

Mr. OLD. Referring to the CIWS, what is the estimated production weight of the system?

Commander MEINIG. The current estimated production weight of the system is approximately 11,400 pounds, sir.

Mr. OLD. That is about the same as the prototype weight?

Commander MEINIG. Prototype weight was 12,700; the operational suitability model weight—and I might add that these weights do include a full load of ammunition and all hydraulics in the mount—was 10,723 pounds.

Digitized by Google

The changes which we are making in terms of foundation and base structure in order to increase the durability of the system and to improve the maintenance, as discussed with the testers at the operational test and evaluation force will introduce a slight increase from the operational suitability model to a projected production model of 11,400 pounds.

Mr. OLD. With that weight, what size ships is CIWS limited to—

Commander MEINIG. There is no limit to the ships that are intended in the U.S. Navy. That weight is not a significant contributor in any of the ship design considerations. That has been exercised through all of the types of ships that Phalanx is intended for in the U.S. Navy.

Mr. OLD. The reason for the question was, the other day Admiral Armstrong, in discussing the SES, indicated that the Vulcan/Phalanx system was a potential system on that. He was talking about a 3,000 ton ship.

Commander MEINIG. Yes, sir.

Mr. OLD. So, for 3,000 tons there would be no problem on putting a 11,400 pound system on board that; is that correct?

Mr. OLD. So, for 3,000 tons there would be no problem on putting a

Commander MEINIG. That is correct I might add that the weight increase that we are introducing in the production configuration will reduce the requirement for system foundation, so that the net weight from a ship installation point of view will be very much the same as the current system.

Mr. OLD. Are there any significant unresolved problems in the CIWS at this state?

Commander MEINIG. No, sir.

Mr. OLD. Did you give us the projected procurement cost for the program?

Commander MEINIG. It has been provided for the record. I can amplify that, if you would like.

Mr. OLD. That is all right.

How many systems does the Navy intend to buy?

Commander MEINIG. At the present time the Navy intends to buy 446 systems.

Mr. OLD. Thank you very much.

Mr. CROMWELL. Could we, in view of Senator Chiles' interest in SIRCS, have the SIRCS presentation, then have some questions on it?

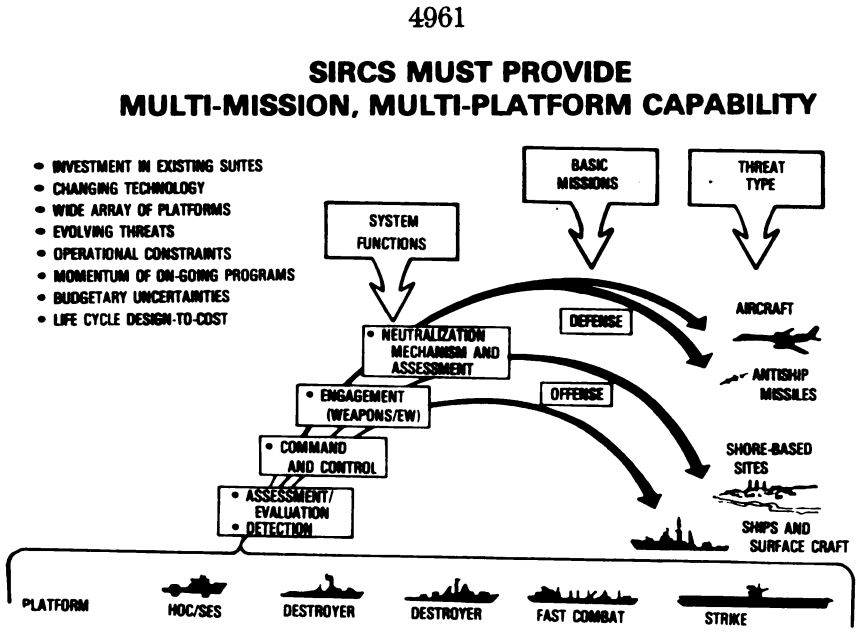
Admiral MEYER. Yes, sir. I would like to ask Commander Mobley to give the presentation.

SIRCS PROGRAM REVIEW

Commander MOBLEY. Good morning, I am Commander Mobley the SIRCS project manager.

This viewgraph shows where we fit into the scheme of air defense. I must point out that the SIRCS is also an offensive system, but that the only part we will address this morning will be the defensive aspects or AAW aspects of the system.

Digitized by Google



The Navy has requested $3.9 million in fiscal year 1978.

SIRCS is a deliberately paced, time phased, major development of a multimission combat system for a wide variety of Navy surface ships in the post-1985 timeframe. The SIRCS system is a total combat system, detection through engagement, that will provide the fleet with a fully integrated intermediate-range air defense, surface offense, and shore fire support capability for intermediate ranges.

It is intended to be complementary to the longer range area AAW systems such as Aegis and Standard missile, and to surface offensive systems, such as Harpoon and the 8-inch gun.

The physical and functional modularity designed into SIRCS permits various configurations to be assembled from standard modules of one basic system, to meet the mission requirements and physical constraints of virtually every Navy ship.

The devlopment objectives require that SIRCS be a logical follow-on to currently planned systems using an optimum combination of selected new developments, installed systems and growth variants of existing systems.

The requirements emphasize improvements in reliability as well as performance, and stress lower cost maintenance and operation by fewer personnel. New developments are to be pursued only in areas where major gains in performance, cost and reliability can be realized, to best capitalize on emerging technology and simultaneously exploit the inherent capabilities and growth potential of existing systems.

This concludes the SIRCS briefing.

[The prepared statement of Commander Mobley follows:]

DESCRIPTION

SIRCS is a deliberately paced, time-phased, major development of a multimission combat system for a wide variety of Navy surface ships in the post-1985

Digitized by Google

time frame. The SIRCS system is a total combat system (detection through engagement) that will provide the fleet with a fully integrated intermediate range air-defense, surface offense, and shore fire-support capability for intermediate ranges. It is intended to be complementary to the longer range area AAW systems, such as Aegis and standard missile, and to surface offensive systems, such as harpoon and the 8-inch gun. The physical and functional modularity designed into SIRCS permits various configurations to be assembled from standard modules of one basic system, to meet the mission requirements and physical constraints of virtually every Navy ship.

The development objectives require that SIRCS be a logical follow-on to currently planned systems using an optimum combination of selected new developments, installed systems and growth variants of existing systems. The requirements emphasize improvements in reliability as well as performance, and stress lower cost maintenance and operation by fewer personnel. New developments are to be pursued only in areas where major gains in performance, cost and reliability can be realized, to best capitalize on emerging technology and simultaneously exploit the inherent capabilities and growth potential of existing systems.

Along this line present and currently planned shipboard systems, such as NATO Seasparrow, Phalanx Ciws, ASMD Missile System, Gunnery System Improvement Program GSIP), and the MK 86 and MK 92 Fire Control Systems are now completing development and entering the fleet. These systems provide the fleet with an effective near-term response to the growing anti-ship missile threat. and are fundamental to the fleet defensive capability for the next 10 to 15 years.

STATUS

In late fiscal year 1976, separate competitive concept design contracts were awarded to three major industry terms. Each team was headed by a prime contractor (McDonnell Douglas, Raytheon and RCA). A team of experts from four Navy laboratories and a federal research center developed the system requirements, defined the threat and provided detailed fleet, weapon system and environmental baseline data for the studies. During the study phase, the Navy team has monitored the contractors' study efforts and initiated development of the evaluation standards and methodology for the concept designs.

Because of the competitive nature of development and the need to protect the integrity of each contractor's concept, the distribution of information is being restricted to official use only. Although the industry concept studies are not scheduled to be complete until March 1977, contractor progress briefings have provided insight into the emerging concepts and conclusions. It appears as if the SIRCS contractors have taken full advantage of the improved opportunity for innovative private sector contribution, by assigning top talent to the program and creating three truly alternative system design concepts in response to the Navy's mission needs. The major part of the evaluation/source selection process is scheduled for completion by the end of fiscal year 1977, SIRCS DCP #163 was approved by SECDEF January 1977.

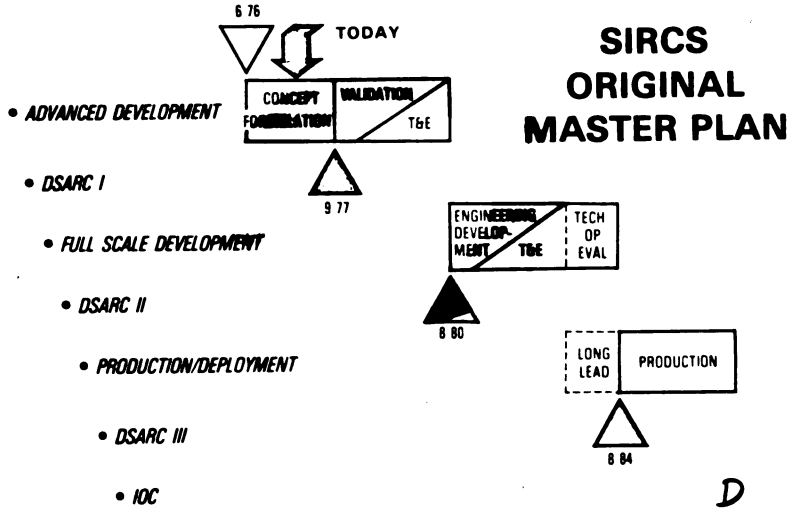
FY 78 OBJECTIVES

The major efforts planned for fiscal year 1978 are to complete evaluation/selection of the SIRCS concept design(s), prepare for DSARC-1, and start validation (hardware development) by mid-fiscal year 1978. It is also planned to initiate a low level risk reduction effort for critical areas of the system designs. All study baseline information, including the threat and 1990 fleet composition, will be updated, and the Government Information Data Center at NSWC, Dahlgren, will be maintained and kept current.

For the fiscal year 1978 we intend to complete the evaluation and prepare for milestone I (DSARC I).

At the same time we must ensure that our industry teams are not lost. We intend to use 1.8M to have our industry teams follow-up on their concept designs by identifying some of the higher risk areas and working on ways to reduce these risk areas.

Digitized by Google



Last years congressional funding has caused a restructuring of the program. The SIRCS schedule remains uncertain at present funding levels. This schedule is not obtainable.

SCOPE OF SIRCS PROGRAM

Mr. CROMWELL. What is a SIRCS? In other words, what specific new items of equipment will be developed, what off-the-shelf items will be used?

Commander MOBLEY. I can answer that in a general sense.

Now that studies are complete, it will consist of a new development for a track-while scan radar and a new missile. From the existing systems it appears that the contractors are proposing the use of the present Navy guns, the guided projectile with some modifications, design to price and parts of the command and control systems that are aboard ships today.

Mr. CROMWELL. It that a new radar and a new 8-inch missile?

Commander MOBLEY. Yes. [Deleted.]

COST OF R. & D.

Mr. CROMWELL. How much will SIRCS cost for advanced development and for engineering development?

Commander MOBLEY. We have not assessed all the studies yet. All I can give you is an approximation of what we think it will cost.

Roughly, it will cost $200 million in advanced development and about $350 million in full-scale development, $300 to $400 million in full-scale development.

We will have a better answer after we get through assessing the studies.

Mr. CROMWELL. That is a rough, ballpark estimate?

Commander MOBLEY. Yes, sir.

Digitized by Google

Mr. CROMWELL. How much fiscal year 1978 funding is required to keep the program on the original development schedule?

Commander MOBLEY. $22.2 million.

SIRCS AND AMRAAM MISSILES

Mr. CROMWELL. Now, the SIRCS system proposal is to develop a completely new 8-inch missile with a [deleted] IOC. As I gather from your presentation, two contractors, presumably, would develop their own prototypes of this SIRCS missile during the advanced development phase. The Air Force and the Navy are requesting funds in their AMRAAM program to start advanced development this year of a completely new medium-range missile with a [deleted] IOC.

Two contractors will develop their own prototypes of that AMRAAM missile during the advanced development phase.

In the past, the 8-inch Sparrow missile had been used by both the air-to-air users and the shipboard surface-to-air users as an almost common medium-range missile.

Will the new air-to-air AMRAAM and the new surface-to-air SIRCS missile be combined into a single development program, and, if not, why not?

Commander MOBLEY. At the present time, since we intend to go into the competitive advanced development, we will be rather flexible in the final version of the missile up until the end of the advanced development period, optimistically in the early 1980's. At this time we are not certain what the AMRAAM mission requirements are.

If they are compatible with the SIRCS mission requirements, we can certainly look at it and determine if there can be some ground for commonalty; but until the requirements for the AMRAAM are stated such that we can compare, to see in what areas we have missions in common, it will be difficult for us to say, categorically, yes, we can.

Our objective, of course, is to get a cost effective system. Anything we can do to lower the costs of the missile would be our goal.

Mr. CROMWELL. Would the Navy propose to look at the AMRAAM to see if there is commonalty before or after the contractors are given the money to build advanced development prototypes?

Commander MOBLEY. I think we have a flexibility in this procurement process such that we can initiate advanced development and still examine the AMRAAM concurrently as we proceed. At any time we see it offers a lower cost alternative, then we could change.

SIRCS DEVELOPMENT COST

Mr. CROMWELL. Why should the missile R. & D. program under SIRCS necessarily be done by the same contractors as the radar developer?

Admiral CARTER. Let me answer that, if I may, please, Mr. Cromwell.

I think the answer to both the question before the House now and the preceding one stems at least in part from an understanding of the acquisition concept of SIRCS.

In responding to the new strategy of acquisition, which is based on the report of the Commission on Government Procurement, we

Digitized by Google

have asked the contractors to come in with an entire system proposal, including, where he felt what was in the inventory and what was in the planning stage already within the Government would not satisfy his system requirements, we gave him the option of stipulating or proposing a new missile which systematically makes sense with the rest of his proposal.

Each of the three contractors who are participating at this stage in SIRCS has indeed come in with a new missile. Each has come in with an entirely different kind of a missile.

The kind of a missile that each contractor has come in with is a proposal which is coherent with the rest of the system that each has proposed. Whether this is in synch with the AMRAAM proposal, I think it would be premature to say either it is or is not. I think, in response to the question as to whether the AMRAAM missile could satisfy the requirements of SIRCS, you have to add to that the additional criterion that it be compatible with the balance of the SIRCS system.

If we don't continue the way we have started, to maintain that system coherency, then the whole concept of this method of acquisition doesn't make a whole lot of sense. So we need to look at both the programs, the AMRAAM and any other programs that may be ongoing; but we are confident that each of the three contractors has already done this.

There is no question, in my judgment, that they have examined everything that is ongoing, and there is a compulsion for each of the contractors to suggest something new and different only where they find shortfalls in already ongoing programs or already planned programs, shortfalls either in terms of meeting the performance criteria or meeting other technical criteria viewed in the context of their whole system proposal.

LACK OF COORDINATION DUE TO A-109

Mr. CROMWELL. Since SIRCS is being formulated under OMB Circular 109, the new procedures which guide Government program development as you just said, now if 109 allows the Navy to go into a missile development program for SIRCS that parallels and duplicates the AMRAAM missile development program, then it seems to me that there could be some inherent deficiency in the 109 process. Very probably that process does not require that coordination exist with other DOD programs.

Do you think that is a valid criticism of 109, because apparently here we have a situation where there is no coordination within DOD on this missile?

Admiral CARTER. No; I don't think this is a valid criticism. As a matter of fact, I think quite the opposite is true.

Each of the three SIRCS contractors were required to familiarize himself with all programs, including AMRAAM, which would have an impact on their proposals.

Now, in our review, our technical review of their three submissions, we need to weigh the merits not only of what they submitted but also the judgments that underline those merits; so that AMRAAM as the

Digitized by Google

example has already been looked at by the three contractors and the fact that all three of them have hypothesized a different missile is indicative at least that there are three groups of people in industry who feel that AMRAAM will not satisfy their technical and operational requirements.

We must again look at their proposals in the same view, not only as to what they propose but also the things that they had available to choose from, and what they did not choose to be a part of their package, so I would submit that this is actually getting twice as much a look now as it would have if we had done business the other way.

Mr. CROMWELL. If I were an industry marketing man, and if I had the choice—if I were proposing to develop just a radar for several hundreds of millions of dollars as my system, or if I could add to that a brandnew missile as well for another several hundred million dollars, I think, from a marketing standpoint and a business standpoint, I would choose to offer both proposals.

But it is the Department of Defense's responsibility to take a look at the total picture of what is being done in R. & D. in the missile area and in the radar area, to make that kind of a decision.

Admiral CARTER. I think we would agree with you, Mr. Cromwell, completely. I believe that is just what I have tried to say, and I would only make one other comment with respect to what you would do if you were an industrialist.

I believe I would do the same thing, but if I were primarily a radar builder, I believe I would be putting my push into the building of the radar. If I were primarily a missile builder, I believe you are right, I would put my push into the missile business first.

The three primes are much more noted for their radar products than they are for their missile products.

Mr. CROMWELL. Admiral?

Admiral DOYLE. I just want to add, it is our responsibility, certainly, in the evaluation of the various proposals to look at exactly what you have stated, and to look at other developments, and we have the option as to whether to select or not select.

Mr. CROMWELL. Do you believe that this issue should be examined by the Navy and by the DOD before you go ahead with SIRCS?

Admiral DOYLE. Absolutely.

Mr. CROMWELL. All right. I have no more questions.

Do you have any?

WHAT SIRCS INCLUDES

Mr. OLD. I guess maybe I hate to put this on the record and look like I am not paying attention, but I still have a difficult time understanding what SIRCS is all about.

In addition, the members have very, very little time to try to absorb these programs, and if someone asked me to explain to them in a very short number of words what SIRCS is, why the Navy needs it and why he should vote for it, what are those magic words? Do you have something like a small handful here?

Admiral DOYLE. Well, let me try one, because I think the SIRCS concept can best be described as a systems approach to the short

Digitized by Google

range antiair/antisurface problem; in other words, it looks at all components as a system from detection to engagement, and in addition it uses a multiplicity of guns, missiles—guns including CIWS—to engage a target; so you get a redundancy in sort of defensive depth, even within the short range.

Now, this is an ideal approach to look at that from a systems point of view without trying to just glue onto a ship individual components that came along sort of independently.

So the stress here is on the systems approach, an integration of all of these systems so they are all working together in a cohesive manner.

Mr. OLD. You are giving me the solution. Maybe it would be better if, in a minimum of words, you just defined the problem for me. The problem, as I see it, is a large number of systems that are attempting to defend the fleet in the intermediate range area, and in some way you have to integrate all of the systems so that, coordinated, they can provide the best defense.

Admiral DOYLE. But we are also projecting the threat, looking at the fleet in the 1990 timeframe, and looking at the increased speed of incoming missiles, their maneuverability and so on, and taking that into consideration so you are not only getting a systems approach but you are also getting an improvement to what we have now.

Mr. OLD. I hate to belabor this but the description says that:

SIRCS is a deliberately paced, time-phased, major development of a multi-mission combat system for a wide variety of Navy surface ships in the post-1985 timeframe.

I suggest that a member, after reading that, doesn't quite know what the system is. Now continuing with the description—

The SIRCS system is a total combat system—detection through engagement—that will provide the fleet with a fully integrated intermediate range air defense, surface offense and shore fire support capability for intermediate range.

Is SIRCS a series of computers or is it, like Mr. Crowmell is talking about, a new 8-inch missile, or is it a series of radars? Where is this thing, and where do you locate it and what does it look like?

Admiral DOYLE. It consists of a new radar.

Mr. OLD. New radar?

Admiral DOYLE. It consists of CIWS, I believe.

Mr. OLD. We have got CIWS.

Admiral DOYLE. That is correct. It consists of existing guns that are already on the ship. They will be integrated into it. It consists of, as he said, a new missile.

Mr. OLD. A new missile?

Admiral DOYLE. A new missile.

Mr. OLD. Does it have anything to do with Aegis at all?

Admiral DOYLE. No, sir; because that is in the long range area.

Mr. OLD. OK. That is too far.

Admiral DOYLE. OK, so now not all ships will get all components of the system. It depends upon the size of the ship and so forth.

Mr. OLD. So far the——

Admiral DOYLE. A building block type of thing.

Digitized by Google

Mr. OLD. The only thing new is a new missile; we have CIWS, and we have certain guns; now we get a new missile?

Admiral DOYLE. Radar.

Mr. OLD. And have to get a new radar?

Admiral DOYLE. And a weapons' control, and all of the computer complex that goes into integration, data management.

Mr. OLD. The whole C3 that ties it all together, one integrated system, right?

Admiral DOYLE. Right.

Mr. OLD. The contractors now are providing their concept of how you ought to handle the air defense mission in this intermediate range area: is that correct?

Admiral DOYLE. That is correct, and they are using a little bit different hardware in each one, but basically they come in—I think it is fair to say—with the same approach to the problem, the same amount of hardware needed to cope with the threat.

Mr. OLD. Admiral Carter?

Admiral CARTER. Maybe it will help a little bit if I can give you the general size of SIRCS, to show you what the problem was and help you understand now what the problem is.

Two years ago the Navy was pursuing almost independently several long term developments. They were pursuing a follow-on missile defense system which required a weapon to be launched, a radar to detect targets and some means of providing guidance.

They were pursuing an offensive system to strike at ships at the horizon and in sight. There were programs ongoing to upgrade our shore bombardment capability. We had on top of that a bunch of—I shouldn't say a bunch—we had several new systems, such as the Vulcan/Phalanx, which were about to deliver; but in amongst all of these new development requirements there was a great thread of commonality; they all required a sensor; they all required weapon control, processing; they all required some kind of a weapon launch.

We determined that all of this redundancy that was ongoing was very expensive and indeed, in our judgment, seemed to be unnecessary, that a single radar, for example, that can detect airplanes can also detect surface ships; a single weapon processor that can process an air engagement should be able to process a surface engagement; a weapon that is capable of shooting down an airplane might be capable of engaging a ship, effecting a mission kill to its rather tender topside sensors and weapon launcher.

We developed, as a result of this look and evaluation, an operational requirement which, take all of these various pieces of requirements that are being pursued independently, tie the whole thing into a combat system requirement and see then how much commonality from the various mission areas we can bring together into a single total combat system utilizing that which is just recently delivered to the fleet, that we have a substantial R. & D. investment in and that will be capable of being effective in the same timeframe that we are talking about for the rest of the combat system.

So we came out, I guess, for the first time in the close-in arena, with a systems approach in an attempt to economize in space, in equipment, in dollars, in any of the other measures of economy that you

Digitized by Google

want to look at, such as manpower, to come in with a coherent system capable of engaging aircraft in close in the same region in which the Sea Sparrow system operates today, engaging surface ships in essentially a reactive mode, and being able to engage targets ashore, using as much common componentry as we can.

That was the general size of the program called SIRCS.

It was decided when the SIRCS operational requirement had been developed and the Materiel Command had begun to develop its responses to that operational requirement, that it would be an ideal vehicle, since it allowed for the exercise of a great deal of initiative on the part of the developing agency, this would be the ideal vehicle to attempt to use this new method of acquisition that is called out now.

The thrust of this was very much to reduce the number of components, to make maximum utilization of the existing components that still will retain their effectiveness in the timeframe that we are talking about.

It is a different way of going at shipboard weaponry; it is something that the Navy has not done with the exception of Admiral Meyer's work in the Aegis system, of coming in with a total combat systems approach to go across several mission areas.

As Commander Mobley has said, the response from the three bidders in industry have, I think, been just great. There is a substantial difference in the approaches taken by the three of them. Some of them, for example, have proposed that they employ their [Deleted] giving it a sort of a double-headed capability.

The radar approaches taken by each of the three are radically different, combat direction system processing is substantially different in the case of [Deleted]. There is an awful lot of innovative thinking that has gone into this by each of the three bidders, and I would say that the risk areas that they have gone to are not really all that substantial, because they are able to take advantage of the fact that we are working in the near region where techniques, that because of inherent inaccuracies will kill you at longe range, can be very nicely exploited in close; and all three of the contractors have recognized this.

Mr. OLD. That is very helpful.

FUNDING FOR SIRCS

So why was the planned amount for fiscal year 1978 knocked out by OSD? With a story like that, how could you fail?

Admiral ROWDEN. I am not sure that we understand the rationals of why OSD knocked that out. It might be partly on the perception of the lack of support that SIRCS received last year in the Congress; that may have contributed to it, and it may be also a perception of an understanding of the program which we have just gone through.

Mr. OLD. Well, at this particular point in time, Admiral Carter, I would judge that you have reasonable confidence that such a system could be designed and built?

Admiral CARTER. I do have. I would say much more so than I had a year ago. I was very much a skeptic as to our ability to translate to the contractors in terms that meant something to them what our re-

Digitized by Google

quirement was. I was not skeptical of their ability to respond to it if we could articulate it properly, but I think that their response shows that either they have a crystal ball or we were much more effective in exposing our requirement than I would have thought we could be.

Mr. OLD. There is $3.9 million in the request this year for SIRCS. Assuming that is the amount you end up with, what happens to the program in fiscal year 1978?

Commander MOBLEY. We will sort of maintain the level of effort; we will do some risk reduction with the industry contractors to hold their teams in place, and we will do some refinement of the baseline information that we provide industry.

Mr. OLD. You wouldn't be getting to the point where you would be deciding which of the three contractors had provided the best——

Commander MOBLEY. We hope to do that this fiscal year.

Mr. OLD. Is that a function of money?

Commander MOBLEY. My present plans are to have this completed by the end of the fiscal year; there is a possibility it can stretch over into fiscal year 1978.

Mr. OLD. What would you use the additional money for then?

Commander MOBLEY. Where?

Mr. OLD. Between the $3.9 million and the original, I guess it was. $22 million?

Commander MOBLEY. That would initiate advanced development. We would actually start hardware demonstrations.

Mr. OLD. So, in any case, you hope to have a contract award; is that correct, a contractor selected? Of the three, you hope to select one in fiscal year 1978?

Commander MOBLEY. Hope to select two.

Mr. OLD. Select two. Regardless of whether the funding changes or not?

Commander MOBLEY. Yes, sir; but if the funding stays as is, we would only select—maintain a very low level of effort to sort of keep the teams together. We would not do any hardware development to speak of.

Mr. OLD. Would DSARC be required before you could move on into advanced development?

Commander MOBLEY. Yes; it would be.

Mr. OLD. And was that subsequently canceled when these funds were revised?

Commander MOBLEY. No, sir; it was not.

Mr. OLD. Was there one scheduled?

Commander MOBLEY. There was not one scheduled at that time, but with the increased funding we would moke DSARC I up, so we could get into advanced development earlier.

Mr. OLD. If the Congress added additional funds that were sustained, there would be a DSARC involved?

Commander MOBLEY. Yes, sir.

Mr. OLD. Thank you very much.

Mr. CROMWELL. Just to correct the record there, it was an internal Navy decision to only request $3.9 million this year rather than OSD cutting off a Navy proposed figure, wasn't it?

Admiral ROWDEN. Yes; that is correct.

Admiral DOYLE. That is primarily a question of affordability.

Digitized by Google

REVIEW OF SIRCS MISSILE ISSUE

Mr. CROMWELL. I may have sounded critical, too critical of the process going on, the Navy having gone out to industry and spent some $4 or $5 million for these total systems design studies. It probably was an extremely good investment, wasn't it? It would give you all kinds of ideas as how to approach the problem?

Admiral DOYLE. Yes.

Mr. CROMWELL. On the other hand, now that you have the ideas, it would be a good idea, wouldn't it, for the Navy to take a look at the question, should you go off independently on the missile?

Admiral DOYLE. Yes, sir.

Admiral ROWDEN. And the process will allow us to do that.

Admiral DOYLE. I think it was money well spent to do what we have done.

Mr. CROMWELL. Senator Chiles has submitted the following question to give to you, and you can answer it for the record.

[The questions from Senator Chiles to be answered on the record follows:]

Senator CHILES. As you know, the Senate Armed Services and Appropriations Committees last year strongly endorsed and supported the Navy's new SIRCS program. Nevertheless, the Navy's FY-1978 budget request reflects only a severely cut back level of funding predicated on cuts applied by the House Armed Services Committee. Could you tell the Committee:

(1) Your view of the program as it is proceeding, especially since it is following the new weapons acquisition policies called for in OMB Circular A-109;

(2) the views of the contractors competing in the program;

(3) what level of FY-78 funding would be required to put the SIRCS program back onto a normal development path?

Admiral DOYLE. Under A-109 policies, we have permitted the contractors full latitude in responding to the SIRCS proposal. The competition has produced some interesting concepts which would provide a significant increase in the Navy's capabilities if pursued without delay, but will diminish in relative effectiveness against the threat as the development period is extended due to funding constraints. Previews of the contractor's proposals indicate that they have made extensive trade-off analyses in arriving at their recommendations, and that A-109 policies provide a new and challenging way of doing business. The policy of industry proposing solutions to mission requirements rather than responding to what is perceived as desirable by the governmental agency also produces a collateral benefit as the proposals can be compared to existing systems to identify strengfhs and weaknesses.

The Navy has commenced source selection for the validation phase. Concurrently contractural negotiations for validation are proceeding. At the completion of source selection Navy, in early October 1977, will sign validation contracts. Hence, Navy is in an excellent position to proceed with a vigorous hardware validation effort in FY-78 and it is estimated that $22.2M would be required to compensate for the FY-77 reduction cited and restore the program to its previous development schedule.

Mr. CROMWELL. Will you insert for the record the presentation of the 5-in. ASMD missile.

[The prepared statement of Captain Mathis follows:]

5" MISSILE FUNDING SUMMARY

I will now present the 5" point defense missile program which is the ASMD missile system.

ASMD MISSILE SYSTEM

The five inch rolling airframe ASMD missile system is one which the United States Navy is developing to provide increased firepower and increased target

Digitized by Google

capacity in ships defended with 8" sparrow and larger missile systems, and to provide a relatively inexpensive missile defense system to a range of ships which otherwise would have no missile weapons systems.

Because of its small size and planned low cost, the five inch ASMD missile system has attracted interest in some NATO countries. In fact, the advanced development phase being conducted this year is in cooperation with and partially funded by the federal republic of Germany.

Congressional direction for this program has been received for the past three years. Reports of compliance to this direction are included in this presentation.

5" MISSILE DETAILED FUNDING SUMMARY

This program is budgeted only in RDT & E at $3.1 million in fiscal year 1977 and $4.7 million in fiscal year 1978.

ASMD MISSILE SYSTEM ENGAGEMENT

By way of review, the five inch ASMD missile system is presented here in simplified form. The system will consist of the radar, electronic support measures (ESM) equipment and combat direction system which exist on any particular ship, plus launching equipment and missile, To detect, process and engage an active threat (that is, a threat which is transmitting RF energy and is in powered flight), the system performs in this manner.

The electronic support measures equipment senses the RF emissions of the threat and determines its bearing and frequency.

The radar detects the threat and determines its range, bearing, and, if available, its elevation.

The ESM and radar threat information is correlated in the combat direction system and is ranked as to priority (that is, unengaged and most threatening). When the threat is designated to the weapons system, its launcher is assigned.

The launching system readies and fires the missile. Upon firing, ship support is no longer required—that is, the ASMD missile system can immediately begin engaging the next target. This ability to engage multiple targets in rapid sequence is one of the more significant attributes of this system.

The missile leaves the launcher and, within its RF field of view (FOV) acquires the RF energy which is being emitted from the threat. While guiding on this emitted energy, the missile is pointing its infrared seeker at the threat, also. When the threat enters the missile's infrared field of view and is of proper intensity, the missile switches to the more precise infrared terminal guidance. At the closest point of approach between the missile and the threat, the fuze activates the warhead and destroys the threat. A contact fuze is activated if a direct hit is achieved.

MISSILE CONFIGURATION

The missile itself will borrow from several other DOD weapons programs. Present intentions are to use either the army Stinger or navy IR guided projectile IR seeker, the sidewinder fuze and warhead and the Chaparral rocket motor. The RF seeker is a variant of that produced for the dualmode Redeye program and the control section is a derivative from Stinger. This maximum use of other production hardware is expected to result in a relatively low unit round cost of approximately $20K.

ACCOMPLISHMENTS—1976

Missile warhead lethality has significant impact upon the selection of its guidance mode. In this view, Congress directed in FY 1975 that this program evaluate and confirm whether this five inch diameter missile could effectively kill an incoming threat. A major determinator of this effectiveness was the naval surface weapons center, Dahlgren laboratory testing which ended in 1976. Fifteen arena tests of the missile warhead planned for the 5'' rolling airframe were made against replicas of the expected threat. These tests when combined with associated analysis of this missile's terminal effectiveness when employing IR terminal homing were even more favorable than had been expected.

The first flight test against a simulated anti-ship missile was conducted at the White Sands missile range, New Mexico. Partial success was achieved. The second and third flights are scheduled next month.

Digitized by Google

The 5'' rolling airframe missile guidance depends on the threat emitting RF and IR energy. Knowing this, Congress directed in FY 1976 that this program continue to study methods to make it effective against an even wider range of threats. This study program commenced in 1976 and concentrated on IR-all-the-way as an alternate guidance mode. We refer to this mode as the Block II missile which will evolve out of the dual mode RF/IR Block I. Studies and employment definition will continue for Block II into this fiscal year. Other tasks undertaken in the study program included maneuverability requirements, RF design, threat definition, preliminary system performance specifications, hardware definition, and simulation update.

Another significant 1976 program milestone has been the formulation and signing of a memorandum of understanding (MOU) between the U.S. Navy and the Federal Republic of Germany Ministry of Defense. The MOU formalizes the agreement of the two governments to share the cost of advanced development phase missile flight tests, related ship system work, and the development of documentation required to initiate full scale development. The FRG share for advanced development is $6.5 million.

FISCAL YEAR 1977 PLANS

During the remainder of 1977 we plan to complete the tasks shown here so that we can request permission to commence full scale development during the first half of FY 78.

A study program will be completed during the second quarter FY 77.

As directed by Congress for fiscal year 1977, joint planning by the program managers for the ASMD missile and the navy guided projectile has laid the groundwork for hardware evaluation of the 5'' IR guided projectile seeker in the ASMD missile. The naval weapons center will conduct side-by-side laboratory tests of the navy's 5'' guided projectile IR seeker and the army's Stinger IR seeker to determine a baseline seeker for the ASMD missile. The tests will measure seeker performance parameters as an element of the ARM/IR guidance system and determine compatibility with the rolling airframe of the ASMD missile. Costs and risks will also be evaluated.

In addition to the flight tests against simulated anti-ship missiles commenced in fiscal year 1976, which will be completed this year, we plan to conduct six more to verify block I airframe configuration.

A ship sensor data correlation demonstration will verify that we can correlate radar and ESM information in the combat direction system and can provide pointing orders to the launching system. The demonstration will be conducted by APL/JHU and Hughes Aircraft Co. and will involve different shipboard sensors.

Full system specifications will be prepared.

Before completion of advanced development, a memorandum of understanding with the Federal Republic of Germany will be drawn up for the full scale development phase. Congressional permission will be requested to negotiate and sign this MOU for full scale development. We plan to complete advanced development of the block I system during the fourth quarter of fiscal year 1977 or the first quarter in fiscal year 1978.

A Navy System Acquisition Review Council will be convened in 1977 to determine the readiness of this program to enter full scale development. No technical problems exist at this time—nor is foreseen to exist—which will preclude entering full scale development.

The sidewinder fuze, which will be used in the block I missile, is an excellent, highly reliable and effective fuze; however, it will be the most expensive component in the missile. We will initiate some feasibility studies at NWC/China Lake to determine if a passive IR fuze could provide improved performance at a much reduced procurement cost.

We also plan to initiate requirements definition of the block III system.

OBJECTIVES—FISCAL YEAR 1978

It is planned to complete NSARC review during the first quarter fiscal year 78 followed by commencement of full scale development of the block I system at the beginning of the second quarter. Initial efforts at the commencement of full scale development phase will include design of the stand-alone launcher and associated control and interface units in accordance with interface requirements and system specifications developed during fiscal year 1977. Similar design efforts will also

Digitized by Google

be carried out for Seasparrow launcher inserts and ordalts. Block I missile design efforts will be continued based upon specifications developed in fiscal year 1977 and upon control test vehicle rolling launch and RF design and testing efforts also carried out during fiscal year 1977. Finally, system integration efforts will continue, based upon fiscal year 1977 radar/ESM correllation efforts and other previous interface requirement definition efforts. Detailed planning will be continued for full scale developmental, subsystem and system level testing as well as planning for initiation of missiles and shipboard equipments production.

In addition to those efforts we will continue advanced development efforts on the block II system missile, commence advanced development of the passive IR fuze if our fiscal year 1977 studies indicated we should, and complete the requirements definition and start concept and trade-off studies of the block III system.

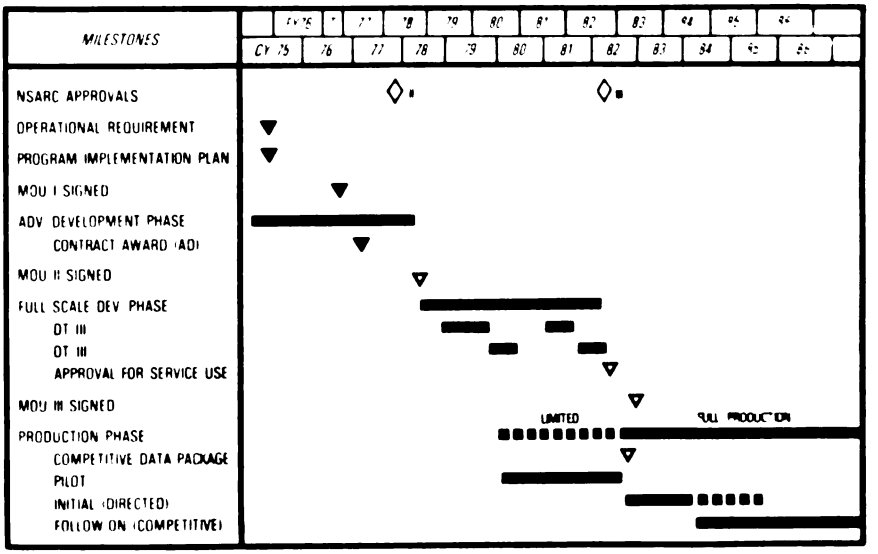
FISCAL YEARS 1977/1978 R.D.T. & E.

Fiscal year 1977 and fiscal year 1978 funding is shown on this chart. The funds are the U.S. share only. Total Federal Republic of Germany funding is $6.5 million and will be spread over the same tasks covered by U.S. funds with the exception of the IR seeker evaluation. German funding requirements will be identified during negotiations of the MOU for full-scale development.

ASMD MISSILE SYSTEM PROGRAM MILESTONES

Program milestones are shown in this chart.

ASMD MISSILE SYSTEM PROGRAM MILESTONES



Mr. CROMWELL. The committee will stand in recess until 9 a.m. tomorrow morning.

[Whereupon, at 12:10 p.m., the hearing was adjourned, the committee to reconvene at 9 a.m., Tuesday, March 15, 1977.]

Digitized by Google

MILITARY PROCUREMENT, FISCAL YEAR 1978

WEDNESDAY, MARCH 15, 1977

U.S. SENATE,
SUBCOMMITTEE ON TACTICAL AIR
OF THE ARMED SERVICES COMMITTEE,
Washington, D.C.

NAVY CARRIER AVIATION FORCE STRUCTURE

The subcommittee met at 9 a.m., pursuant to notice, in room 224, Russell Building, Senator Barry M. Goldwater, presiding.

Present: Senators Goldwater, Tower, and Thurmond.

Also present: Charles Cromwell and Robert Q. Old, professional staff members.

Senator GOLDWATER. The meeting will come to order.

Again, the chairman is detained because of family illness in Nevada. I must apologize for a very busy morning. I have to get my passport renewed at 9:30 so I will be gone for a while and we have a full committee meeting, so you gentlemen will probably have to put up with our intelligent staff.

CHAIRMAN'S OPENING STATEMENT

This morning the subcommittee concludes its hearing on the programs in the fiscal year 1978 budget request, with a review of the Navy carrier aviation force structure and associated aircraft programs. We will start off with a summary on the 6th Fleet carrier operations, will receive our annual update on the force structure and will have presentations on the F-14, F-18, A-6E, A-7E, E-2C and EA-6B airplanes, the combat training programs, and a status report on the Navy reconnaissance program.

Also this morning the Hon. Dale Milford, Congressman from the 24th District of Texas, has requested an opportunity to present a statement on the Navy A-7E program, and we are happy to have him join us today.

Our principal witnesses this morning are: Vice Adm. F. C. Turner, USN, Deputy Chief of Naval Operations (Air Warfare); Lt. Gen. T. H. Miller, USMC, Deputy Chief of Staff for Air; and Vice Adm. F. S. Peterson, USN, Commander, Naval Air Systems Command. They are supported by the program managers.

Congressman Milford, will you proceed?

88-379 O - 77 - 27

Digitized by Google

STATEMENT OF HON. DALE MILFORD, CONGRESSMAN FROM TEXAS, 24TH DISTRICT

Mr. MILFORD. Mr. Chairman, members of the committee, I appreciate the privilege you have accorded me in appearing before you today in support of continued procurement of the A–7E aircraft for the Navy.

As you may know, the A–7E aircraft is produced in my district in Texas by a company that is the second oldest aircraft manufacturer in the country and one which has probably as good a record as any company in America over the past 20 years of delivering products to the Defense Department on a schedule, at cost, and with all performance requirements met.

This company is the second largest Government prime contractor in Texas, employing over 9,000 people. The premature stoppage of the A–7E line, as proposed by the Secretary of Defense, will not only threaten this company's compatibility as prime Government producer, but also forces a layoff of several thousand skilled craftsmen in the near future.

As you can see, I have a parochial interest in the Department of Defense's proposed decision to stop production of this aircraft. I recognize that all aircraft lines have to stop at some point in time when new, more capable aircraft enter the force. This is a natural progression of things. My concern, however, and the reason I am testifying before you today, is that the A–7E line will be terminated while there is still a demonstrated need for additional procurement of this aircraft for the Navy. The question is can the United States afford to close this line prematurely while this need exists?

Let me quickly review the decision process in OSD which led to the proposal to a buy of six A–7's in the fiscal year 1978 Ford budget, and the later proposal in the Carter budget to terminate procurement of the A–7. As late as January 1976, the Navy had a requirement to procure 120 additional A–7E's, if force objectives were to be met.

At this time, the 5-year defense plan reflected procurement of 30 A–7E's each year, fiscal year 1978 through fiscal year 1981. A later decision by the Navy and OSD to utilize F–14 aircraft instead of the A–7 aircraft for the reconnaissance mission reduced the requirement for A–7E procurement by 36 units for a total requirement of 72 new production aircraft.

As late as October 1, 1976, the Navy budget reflected a buy of 27 A–7Es in each year fiscal year 1978 and fiscal year 1979. On November 9, 1976, the OSD decided to procure additional A–6E all weather attack aircraft and to terminate the A–7E line. The Navy reclaimed, in vain, to the requirement for an additional 36 A–7Es that were required, in spite of the added buy of A–6Es, if light attack forces were to be maintained.

Secretary Rumsfeld finally included a procurement of six A–7Es in the fiscal year 1978 budget, which were requested on the premise of keeping the A–7E line open until consideration of a sale of a quantity of A–7s to Pakistan could be resolved. This decision ignored the hard requirement that Navy had for a minimum of an additional 36

Digitized by Google

A–7E aircraft. Secretary Brown, in his review of the budget, concluded that six additional A–7E's would not add significantly to the effectiveness of the light attack aircraft force, so he proposed eliminating the buy in fiscal year 1978. This decision also ignored the Navy requirement for additional A–7E aircraft.

Why is it important to the security of the United States to be concerned over a decision to stop an aircraft line when only 36 additional aircraft are required from that line? First, if the A–7E production line is terminated with fiscal year 1977 procurement, the Navy, at best, will have no proven light attack production line in being for 5 years, even if the A–18 program does not slide.

Second, if the line is terminated in fiscal year 1977, the Navy will be forced—after having reached their planned goal of an all A–7E force in 1980—to then transfer earlier model, less capable A–7A and B aircraft from the Reserves to the active carrier force for a number of years until the A–18 is phased in and begins to replace the A–7. Obviously, this would have a double-barrel impact on the Navy, downgrading both Reserve and active carrier force readiness.

Let me say a few words about the A–18, the attack version of the F–18, now under development, which is being designed to fulfill the Navy light attack requirement in the future. As a taxpayer, I hope the A–18 development program remains on schedule. As a realist, I recognize the distinct possibility of slippage in what is now a "paper" aircraft, but currently planned for fleet introduction in 1985. Unforeseen slippage in the A–18 would further impact the light attack force without additional A–7E procurement now.

Not only is the procurement of 36 A–7Es vital to the Navy's maintaining their minimum planned light attack force, but failure to keep the A–7E line open for at least two more years will cause a serious unemployment problem in my district. As I mentioned earlier, Vought Corporation is the second largest Government prime contractor in the State of Texas. They had an employment of more than 9,000 people at the end of 1976. If they are forced to terminate their A–7E line, it will be necessary to lay off 7,000 skilled workers in the next 2½ years. This, in itself, is vastly inconsistent with the President's desires to reduce unemployment.

In addition, as in all aircraft procurement programs which are terminated early, there are termination charges that have to be applied to that program and allowable increased costs resulting on other Government programs applied. The net result of this, I understand, amounts to approximately $70 million for which the Government gets nothing.

In summary, there is a hard requirement for a minimum buy of an additional 36 A–7E aircraft if Navy force levels are to be effectively maintained in the 1980's. I respectfully request that this committee, in its deliberations for the Defense Budget request, authorize a quantity of 24 A–7E aircraft in fiscal year 1978 and authorize advance procurement funds for a buy of an additional 12 A–7E aircraft in fiscal year 1979.

Digitized by Google

Mr. Chairman, I appreciate your hearing my testimony. I will be glad to answer any questions.

Senator GOLDWATER. Thank you, Congressman Milford. I have no questions. I am much in sympathy with your request. I am not sure—we have not had the full meeting of the Tacair Subcommittee but I think you will find a friendly feeling about the A–7 in this committee.

Do you gentlemen have any questions?

Mr. CROMWELL. No, sir.

Mr. MILFORD. Mr. Chairman, I appreciate it.

Senator GOLDWATER. Do any representatives of the Navy or Marines have any questions to ask the Congressman on the A–7?

I have to say the thing that bothers me is whether or not the F–18 is actually going to be on schedule. It is not on schedule now in my opinion. It is a paper airplane. I doubt seriously that it is going to get off the ground when it is expected to. So as I said, I think you will find this subcommittee and the full committee are friendly toward your proposal.

Senator Hart, do you have any questions of Congressman Milford? He has testified in favor of an additional buy of the A–7 aircraft for the Navy.

Senator HART. I am not prepared to ask questions now nor make comment but I might in the next day or so.

Mr. MILFORD. I would be pleased to respond to any questions you might have if you mail them to me or send them over.

Senator HART. Thank you very much.

Senator GOLDWATER. Admiral Turner.

6TH FLEET OPERATIONS IN THE MEDITERRANEAN

STATEMENT OF VICE ADM. F. C. TURNER, U.S. NAVY, DEPUTY CHIEF OF NAVAL OPERATIONS (AIR WARFARE)

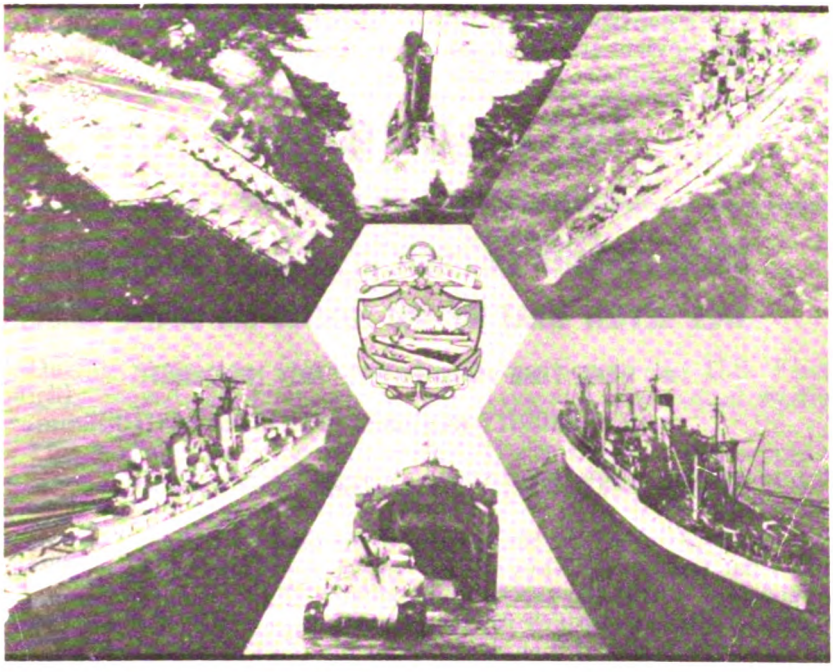
Admiral TURNER. Mr. Chairman, it is a pleasure to be here and to lead off in this program about Navy carrier aviation. As you have outlined the program this morning, I will start with a brief review of operations in the 6th Fleet.

Prior to coming to my present position I was commander of the U.S. 6th Fleet in the Mediterranean for 2 years and prior to that commander of the carrier strike force in the same fleet also for 2 years. The events I am going to describe this morning concern the 6th Fleet operations during the Yom Kippur war in October and November, 1973.

The purpose of the presentation is to illustrate the use of our carrier aviation in a fleet role in support of national policy, national strategy, to indicate the way in which the fleet was employed, particularly the role of aviation, to indicate the tactics involved in fleet employment, to indicate also the very significant introduction of the Soviet Fleet into the waters and what that might portend for the free world.

So let me illustrate quickly the 6th Fleet. As you know, the fleet has been in the Mediterranean for the better part of a generation.

Digitized by Google



Up until 12 to 15 years ago it was unchallenged. It was totally supreme. At that time an occasional Russian ship was seen but in the intervening years quite a significant series of events took place and the Soviets introduced a fleet in that water.

ARAB - ISRAELI WAR

WHAT HAPPENED AT 1420 ON OCT 6, 1973?

I will talk about the Arab-Israeli war and some of the interesting aspects of it which have lessons for us. As indicated here on October 6, 1973, suddenly and without warning the Egyptians struck across the Suez Canal out into the Sinai.

CHALLENGE

FACE TO FACE WITH THE SOVIET NAVY

Digitized by Google

In a matter of a few hours we found the U.S. 6th Fleet rapidly entering into a confrontation with the Soviet Navy as both the United States and Soviets attempted to influence these events to bring about a cease fire to support their own allies.

INTRODUCTION

CRISIS PROVIDED SNAPSHOT OF CURRENT CAPABILITY

WILL REVIEW WHAT WE AND SOVIETS DID DURING CRISIS

- **REAL TIME PERSPECTIVE, NOT HINDSIGHT**
- **SUPERIORITY REQUIRES OPERATING LATITUDE**

SOVIET NAVY MOMENTUM LEADING TO DOMINANCE

We will cover briefly the nature of the crisis, what the U.S. Navy did, what the Soviet Navy did. I will be speaking from a real time perspective. I was the tactical commander at that time in command of the carriers, all support forces, submarines, surface combatants and patrol aircraft. All of them were under my tactical command.

THREE PHASES

6 - 10 OCT: ARAB-ISRAELI SQUARE OFF

11 - 24 OCT: SUPERPOWER INVOLVEMENT-RESUPPLY

25 OCT - 17 NOV: STAGE SET FOR U.S.-SOVIET CONFRONTATION

We will look at how this all took place in three phases, for convenience. Phase one, right after the war as the superpowers quickly moved forces to the area; second, superpower involvement and resupply; and third, the nature of the confrontation and the tactics employed by both sides. On our part to insure that the fleet was available to carry out all U.S. policy and directives and, on the other hand, to indicate how the Soviet Navy tried to interprose itself in that particular situation.

Digitized by Google

PHASE ONE (6-10 OCT)

TENSIONS -- LOW

- MISSION OF 6THFLT/SOVMEDFLT
- FLEET POSTURE/MOVEMENTS
- READINESS
- TRAINING

During phase one, October 6 to 10, the Soviet and U.S. Fleets quickly moved out from where they were and commenced routine training.

This is where the ships were located. The Soviets had three cruisers in the middle of the Mediterranean, amphibious forces in the Middle East area, and area submarines; a fleet of the size of about 50 ships, half of which were support ships, half combatant, with about 12 to 15 submarines at that time.

The U.S. 6th Fleet was composed of about 45 ships. Two carrier task groups, supporting ships, 10 support ships, an amphibious task group, and submarines.

The Soviets were primarily anchored at Kithira, the offshore area south of Greece, and in Sollum, north of Egypt. These are various units.

Digitized by Google

Here, following their practice of a lot of time at anchorage for routine maintenance. Here is a submarine alongside a tanker. This was normal procedure for the Soviets. At Sollum also was this Juliet submarine. In the background a cruiser. As I indicated earlier between [deleted] Foxtrot submarines were on patrol throughout the Mediterranean.

There was one Charlie submarine, nuclear-powered, capable of firing the SSN–7, at ranges up to 30 miles.

Alligator LST's near the vicinity of the Middle East. Five intelligence collectors throughout the Mediterranean, and a very significant air threat based in the Crimea, and these TU–15 Badgers equipped with AS air-to-surface missiles. The U.S. Fleet, as I have indicated its composition, had two carriers at that time. This is the *Independence*, which was my flagship.

[Discussion off the record.]

Admiral TURNER. *Independence*, my flagship, was in Athens, Greece. These are destroyers in the home port squadron, also in Greece. *Franklin D. Roosevelt* was in the vicinity of Spain. The amphibious task forces—Task Force 61—were east of Crete and embarked on those ships were 2,000 marines of Task Force 62.

Also, part of that force was a helicopter carrier.

Digitized by Google

PHASE TWO (11-24 OCT)

TENSIONS -- MEDIUM, MOUNTING

FLEET POSTURE
FLEET TASKS
READINESS INCREASED
TRAINING REFOCUSED

This phase the ships moved out to sea. The conflict and tensions began to mount as the war did not end quickly and dragged on.

Both Israel and Egypt declared war zones as shown here in red. Libya declared a zone [deleted], the U.S. Government outlined areas in which U.S. Forces would not operate. My forces moved to an area [deleted] as indicated by the blue circle. Our general plan of operations is indicated here to plan for and position forces to seal off entrances and exits to the Mediterranean to operate in that area marked by the blue box [deleted] and to utilize the submarine forces available to me in an area defense.

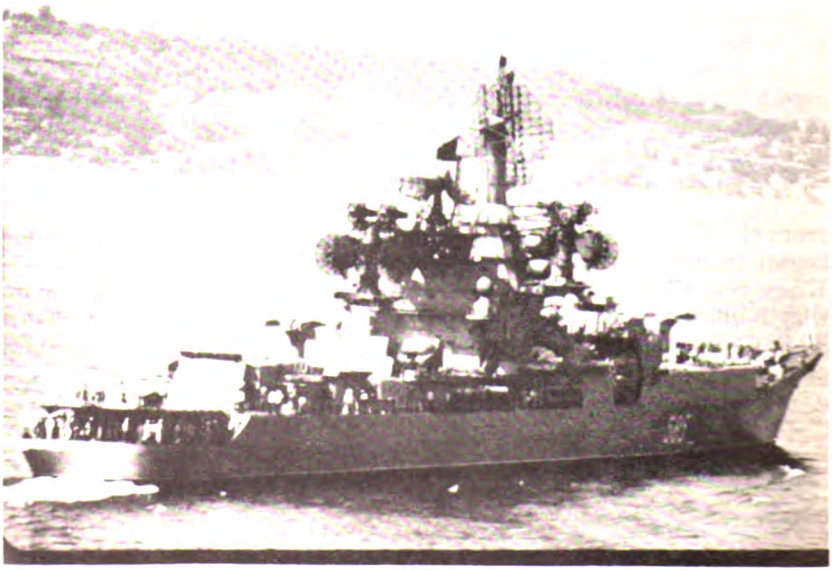
It became apparent we needed to maintain a complete position on all Soviet Forces and the P–3's were utilized in this fashion. Carrier-based ASW aircraft were also active, looking for Soviet submarines. The E–2C was employed [deleted]. Reconnaissance airplanes played a key role, particularly in response to national tasks, [deleted]. The need for national intelligence was acute [deleted]. As I indicated, fighters were maintained airborne around the clock from the various carriers [deleted].

Attack aircraft were maintained airborne constantly, capable of ready response [deleted] and being responsive to what might occur. A–7's as well were airborne [deleted]. Tankers played a key role. The need to keep aircraft airborne constantly, to have extra fuel available if needed highlighted a need for maintaining the KA–6 tanker line. They were handy for us at that time. The reliable workhorse, the COD, was used on countless occasions to bring extra people. We found staying on the line week after week we needed to bring more people from the United States. They came via the old C–1 COD. The Soviets began to build up their forces meanwhile and introduced from the Black Sea Fleet and some from the northern fleet, new ships such as this *Kynda* cruiser.

Digitized by Google

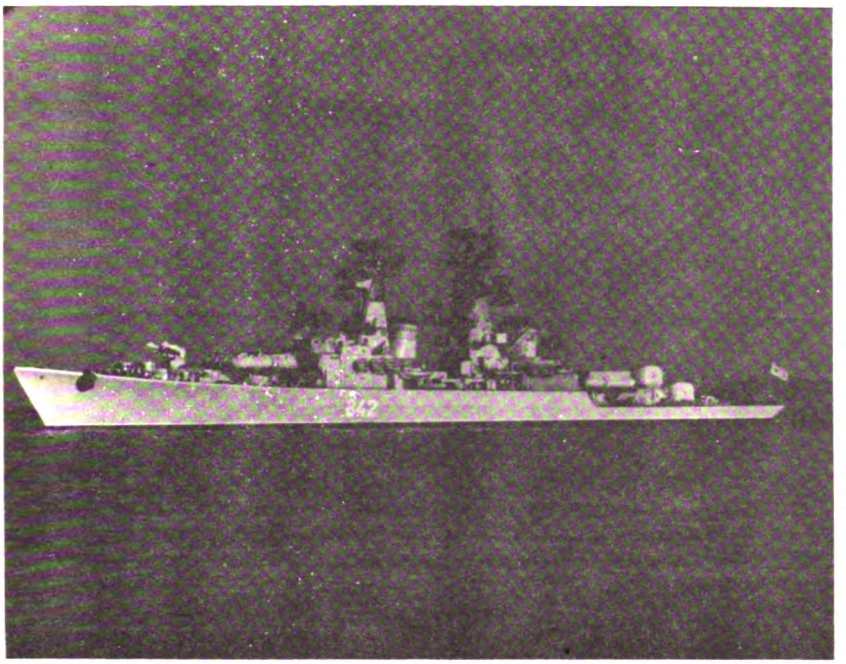
Senator GOLDWATER. What size is that ship, is that a ***Kiev?***

Admiral TURNER. No, sir. The first one is the ***Kynda*** cruiser—this is the new cruiser, *Kara*, about 8,000 tons.



Digitized by Google

This is an SAN–3 missile launcher. All of these Soviet surface ship classes have names beginning with K. This is the *Kynda*, carrying 16 SSN–3 long range missiles [deleted].



Kashin destroyers also came through to augment their fleet, as well as *Kresta* cruisers. Meanwhile, we augmented the U.S. 6th Fleet with [deleted] the U.S. carrier *John F. Kennedy* and her escorts. So, during the second stage there was an intense and rapid buildup of all forces: The Soviet forces increasing from about 50 plus to a high of 96 in a short period of time, and the U.S. Forces from 45 to 67 in like period of time.

I mentioned earlier the air threat from the South. Egypt, Libya, and Algeria possessing aircraft of the MIG–19 variety and MIG–21s. This became very important as we early on found we needed to resupply and establish quite a significant airlift. [Deleted.]

Senator GOLDWATER. Let me ask you, Admiral, as a former commander of the 6th Fleet, what do you view as more threatening, the Soviet naval forces or the land-based aircraft around the southern shores of the Mediterranean?

Admiral TURNER. The most worrisome threat is the [deleted] submarine [deleted]. Immediately behind that I place the long-range bomber, the [deleted]. So it is the question of the stealth and the threat of that submarine, and then the threat of long-range air. The third threat is the surface platforms carrying missiles with them. Then the other submarines, so it is in that kind of order of menace or threat in my estimation.

Digitized by Google

The airlift during the second phase, involved C–141's and C–5's transiting from the United States to Israel along these white lines through the Mediterranean. Landing rights were not available from our allies throughout the Mediterranean area [deleted].

[Deleted.]

A constant flow of 141's and C–5's transited that route, covered and watched by the U.S. 6th Fleet.

[Deleted.] This was the only way possible at that time due to the absence of friendly bases on which these aircraft could land.

PHASE THREE
(25 OCT - 17 NOV)

TENSIONS -- RATHER INTENSE

FLEET POSTURE

DISPOSITION

READINESS

This is the final phase, phase 3, where the tensions ran high. The fleet posture was of maximum readiness. All training ceased. It was a matter of readiness for whatever event might occur. I mentioned earlier that one of the primary missions of the 6th Fleet was to be responsive to national tasking for a possible evacuation of U.S. citizens or other nationals from any one of the number of ports. The amphibious force was there to do that and protection was to be provided by the carrier forces. The introduction of so many Soviets has made the situation one of concern as to what the Soviets might do.

[Deleted.]

Again the operating area, [deleted].

This is the area of operations indicated on this chart, the blue area, [deleted].

[Deleted.]

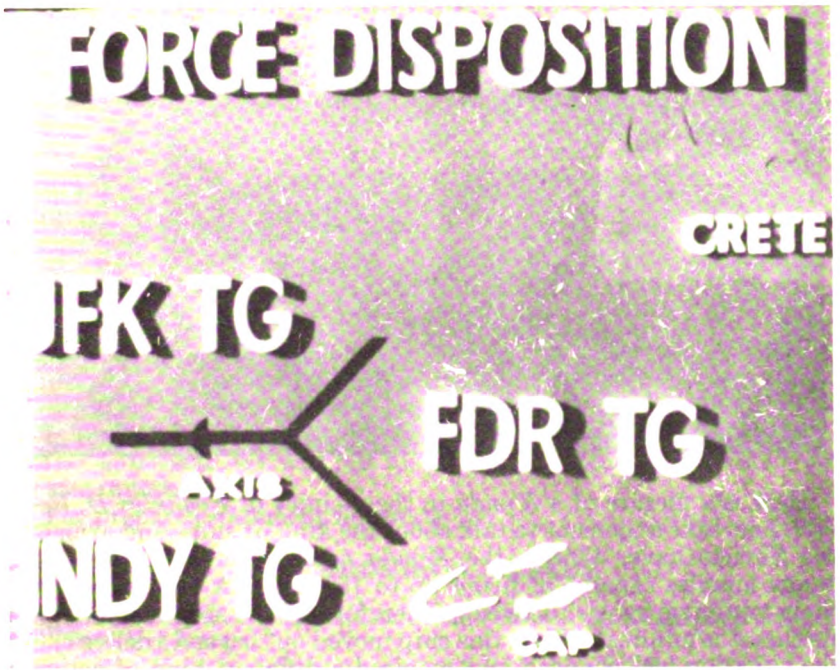
[Deleted.] This is an event which occurred on October 27 which was in my view the most tension-laden moment. At this time the *Kennedy* task group was roaring across the Mediterranean to reenforce

Digitized by Google

the *Independence* and *FDR* here [deleted] amphibious forces were a little further to the west.

[Deleted.] This was unusual. It had only occurred once before [deleted]. This was a moment of some consternation and extra concern. I launched additional aircraft to be prepared for whatever might eventuate.

[Deleted.]



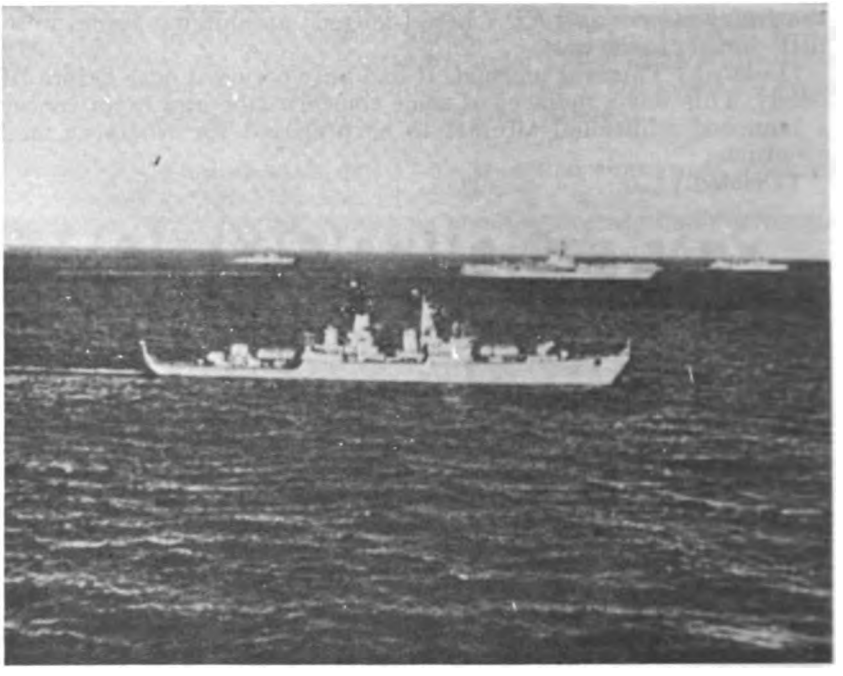
Upon arrival of the *John F. Kennedy* there were three carrier task groups operating in this moving disposition. Each group had a section of the sea, was free to operate in mutual support but independently, all controlled by the one force task commander, all communications linked. There are [deleted] elements of defense in depth in each of these task groups.

This is the Soviet threat at that time. [Deleted.]

What kind of fire power did they have? This is distinct from the air power in the Crimea. Here is first launch capability. These kinds of numbers in surface to surface missiles, for torpedoes, for surface ships to submarines. Refire capability. In sum, there was a very significant missile capability by the surface antisubmarine fast combatants in our vicinity.

[Deleted.]

Digitized by Google



Here is a picture of a *Kynda* in the vicinity of *Franklin D. Roosevelt.* Lets take a moment to talk about the kind of ships and armament the Soviets have. This is the *Kynda* again with 16 SSN–3, long-range missiles capable of firing up to 150 miles. A key ingredient is their minimum range [deleted]. Therefore, if the ship is in this close its threat is minimal. When this ship moved out beyond [deleted] then the situation had changed and required a different kind of action on our part.

[Deleted.]

I mentioned my concern as a result of the confrontation of a size not seen before. Ships were all over the ocean. There were many submarines and a continual concern for what the Soviets might do. The U.S. forces were conditioned and prepared for evacuation anywhere and to do that regardless of the opposition. Obviously the rules of engagement were very important. [Deleted.]

This is quite unlike a situation where the forces are not in contact. Then it is a matter of finding, locating—and attacking you would want standoff weapons. But here in this case standoff did not have much meaning because everybody was so close together. This then was the situation. The first of its kind.

Here we show an example of the kinds of defenses employed in each particular task group [deleted] intelligence that tell us what is about to happen.

[Deleted.]

The Soviets employed a "tattletale" in the vicinity of our forces [deleted]. That is just [deleted] the element of the defensive measures employed. During this confrontation period every ship, every aircraft played a part in the total preparedness so that we would not be sur-

Digitized by Google

prised. I did not think the war was going to start here but my job was never to be surprised, to use my forces such that if any hostile act might occur we were best prepared and configured in all events to retaliate [deleted] my requirement to have ordnance on targets in any kind of situation like this.

The E–2 was used to surveil [deleted.]

This chart indicates the actions contemplated should an attack commence [deleted].

BREAK IN SIXTH FLEET BRIEFING

Senator HART. Excuse me, Admiral. I apologize. I have to leave to chair another meeting. I was out in the Mediterranean this last December and I have a number of questions and observations to make and I hope to get back in time to do that. Other members are going to be joining us here shortly so I suggest you go ahead. Some people will be coming in. Excuse me.

Mr. CROMWELL. I would like to suggest, why don't you hold up here. I believe Senator Tower will be in, and I know he would be very interested in the wrap-up of this. We have a large number of programs to go over this morning. Why don't we put a hold here and since it is only staff here right now, let's take the E–2C program at this point in time.

Admiral TURNER. This is Captain Moore, project manager of E–2C program, who will speak to the details of this program.

Mr. CROMWELL. We will put his statement in the record and I will ask some questions.

[The prepared statement follows:]

E–2C PROGRAM REVIEW

Captain MOORE. Mr. Chairman, I am Captain Moore. I am pleased to present the E–2C Hawkeye program.

E-2C "HAWKEYE"
AIRBORNE EARLY WARNING AIRCRAFT

DESCRIPTION/MISSION

AEW INVENTORY

MILESTONES

FOREIGN MILITARY SALES

FY-78 REQUEST

TOTAL PROGRAM

SUMMARY

Digitized by Google

This is the outline I will follow today.

The E–2C is a twin engine turbo prop carrier-based aircraft built by the Grumman Aerospace Corp. in Bethpage, N.Y. It carries a crew of two pilots and three system operators. The E–2C uses the same basic airframe as its predecessor, the E–2B, which it replaces, but this is where the similarity ends. All of the mission avionics in the E–2C is of new design, allowing this aircraft a much greater performance capability than the E–2B. For example, the E–2C can detect aircraft flying over land, and uses passively detected electronic emissions to help identify radar targets—tasks the E–2B cannot perform. This highly versatile aircraft performs the AEW command and control mission far more reliably and for less maintenance manhours per flight hour than the E–2B.

[Right Slide on—Slide 4.]

The E–2C is a key element in today's integrated naval warfare system. The aircraft is required to permit the task force commander to exercise command and control functions at extended ranges from task force center. Utilizing its radar and passive detection system, the E–2C can detect, track and, to some extent, identify hostile air and surface elements. Digital data links permit both exchange of tactical information and direction of intercepts and strikes. The E–2C and F–14 have been integrated with a fully automated two-way data link and represent the finest air intercept team in the world today.

AEW INVENTORY

E-2B

FIRST DLVRD 1960

41 E-2B & 2 TE-2A

BASED MIRAMAR - DEPLOY LANT & PAC

RESERVES - MARCH '77

RETIRE STARTING 1979

E-2C

FIRST DLVRD JAN '73

34 ACCEPTED (1 STRIKE)

1 TE-2C, 1YE-2C

BASED NORFOLK, DEPLOY LANT & PAC

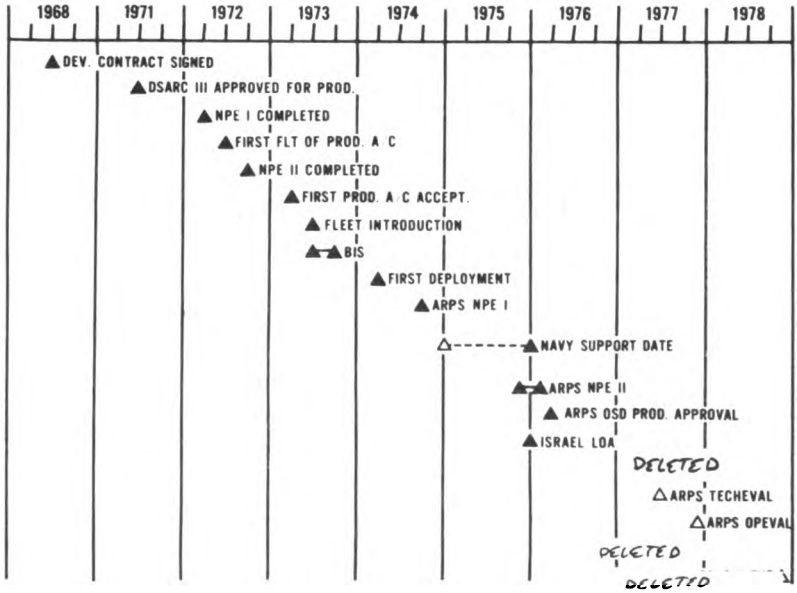
6/YR THRU FY-83, TOTAL: 83

The E–2 series aircraft was first delivered in 1960 as the E–2A. These aircraft were all converted to E–2Bs by 1970. In fiscal year 1978 we will have five operational squadrons, one reserve squadron, and one training squadron equipped with E–2Bs. We will start retiring E–2Bs in fiscal year 1979. The first E–2C was delivered in January 1973. As of January 1, 1977, 34 operational E–2C aircraft and one TE–2C trainer have been accepted. The TE–2C was originally delivered as an E–2A, was modified to become a prototype YE–2C, and is now performing well as a trainer in the readiness training squadron at Norfolk. The

Digitized by Google

YE–2C, converted from one of the original E–2As, is still in service providing test and evaluation support. The program calls for six E–2Cs per year through fiscal year 1983, a total of 83 production aircraft in order to achieve our goal of an all E–2C force. This total reflects FYDP procurement years 1981 through 1983, which were not included in last year's briefing. The continued procurement is requested because of a Navy decision that a carrier E–2C squadron size of four vice three is necessary. This decision was discussed informally in the Senate last year and discussed in the hearings of the House Appropriation Committee.

E-2C MILESTONES



The E–2C program was initiated in 1968. As shown on the milestone chart, progress has been very much according to plan. It is significant to note that when the original 28 aircraft E–2C program was completed in December 1975, our performance and schedule requirements had been met or exceeded. The cost of this 28-aircraft program was $846.5 million—a savings of $10.5 million compared to the estimates made 5 years earlier at program approval.

The ARPS modification to the radar system, which provides improved performance in the presence of jamming and automatic detection and tracking of targets over land, is now in full production. The first ARPS, or advanced radar processing system, equipped E–2C was accepted in November 1976, 1 month ahead of schedule. The formal testing of ARPS will reach its final stage when the operational evaluation commences in December. The first ARPS deployment is scheduled in [deleted] on board [deleted].

We have now completed four highly successful deployments with the 6th Fleet in the Mediterranean Sea. This April another milestone will be met when an E–2C squadron from Norfolk deploys for the first time to the western Pacific on board the *U.S.S. Constellation*. In [deleted] another Norfolk-based E–2C unit will deploy [deleted] later this year, the Pacific fleet will receive its first homeported E–2Cs when VAW–114, an E–2B unit based at Miramar, begins transition to the new aircraft.

88-379 O - 77 - 28

Digitized by Google

FOREIGN MILITARY SALES

- **IMPORTANCE -**

  INCREASED PRODUCTION/SHARED COSTS

- **CURRENT CASE - 4 E-2Cs FOR ISRAEL**

  LTR OF INTENT SIGNED 31 DEC 75

  LTR OF ACCEPTANCE SIGNED 10 FEB 76 FOR $141M

  SITE SURVEY COMPLETED APR 76

  SUPPORT AMENDMENTS WILL INCREASE TO $163M

The Government of Israel is buying four E–2Cs with ARPS and support with deliveries commencing in [deleted] this program was initiated when the Government of Israel signed a letter of intent December 31, 1975. The letter of offer and acceptance was signed in February 1976 at $141 million, but with support amendments this is expected to increase to $163 million. This committee's action last year reduced the Navy's fiscal year 1977 request by $10 million to account for projected savings due to the Israeli procurement. There is expected to be little impact on the Navy program because of the Israeli sale since all training is programed to be accomplished at Grumman.

E-2C HAWKEYE

MANUFACTURERS

AIRFRAME
GRUMMAN AEROSPACE CORP.
BETHPAGE, L.I., N.Y.

ENGINE
DETROIT DIESEL ALLISON DIV
GENERAL MOTORS CORP.
INDIANAPOLIS, INDIANA

QUANTITY	FY 78 REQUEST		UNIT COST
6	WEAPONS SYSTEM COST	$ 194.6 M	$ 21.4 M FLYAWAY
	FLYAWAY $ 128.4 M		
	SUPPORT 65.9		
	ADV PROC (PRIOR YR) -11.1		
	ADV PROC (CUR YR) 11.4		
	INITIAL SPARES	$ 2.0 M	
	TOTAL PROCUREMENT COST	$ 196.6 M	

PROGRAM STATUS

INVENTORY 1 JAN 77	FUNDED & UNDELIVERED	PROCUREMENT COST THRU BUDGET YR
34	13	$ 1311.2 M

Digitized by Google

This is the fiscal year 1978 budget request for six E–2C aircraft. The support cost is higher this year because of the procurement of the second tactics trainer which will be installed at the west coast training site at NAS Miramar, Calif. The weapons system cost is $194.6 million. With $2 million for spares, the total procurement cost is $196.6 million.

FEB 77

E-2C PROGRAM COSTS

($ IN MILLIONS)

	CURRENT & PRIOR YEARS	FY-77	FY-78	FY-79	FY-80	FY-81	FY-82	TO COMPLETE	TOTAL
PROC. COST	958.1	156.5	196.6	192.0	185.6	172.1	181.8	213.9	2256.6
RDT&E	208.0	-	-	2.2	4.3	2.7	10.7	-	227.9
MILCON	0.9	-	-	-	-	-	-	-	0.9
TOTAL PROG	1167.0	156.5	196.6	194.2	189.9	174.8	192.5	213.9	2485.4
TOTAL A/C	43 *	6	6	6	6	6	8	6	85*

* INCLUDES INCLUDES 2 R&D AIRCRAFT

The total program calls for procurement for six E–2Cs per year through fiscal year 1983 for 83 production and two R. & D. aircraft.

SUMMARY

- **MISSION**
  - AEW, COMMAND AND CONTROL
- **INVENTORY**
  - GOAL: ALL E-2C FORCE
- **MILESTONES**
  - ON TIME
  - LESS COST
  - BETTER PERFORMANCE
- **FOREIGN MILITARY SALES**
  - ISRAEL - 4 ACFT
- **FY-78 REQUEST**
  - 196.6M, 6 ACFT
- **TOTAL PROGRAM**
  - 83 PROD. ACFT THRU FY-83

Digitized by Google

In summary, the E–2C is required to perform the airborne surveillance/command and control mission. The program is progressing well toward the goal of an all E–2C force. Program cost and performance objectives continue to be met. A modest FMS program is proceeding well and has already afforded savings to the taxpayers. The important ARPS change is on schedule with delivery of the first production system 1 month early. The fiscal year 1978 budget is $196.6 million for six aircraft.

Mr. CROMWELL. This is a fairly routine ongoing procurement. I do have some questions for the subcommittee which I would like to go over. What is the total planning for the E–2C.

Captain Moore, the basic change in E–2C program since our hearings a year ago appears to be Navy programming for an all E–2 carrier-based airborne radar warning force. Based on the requirement for four planes per carrier. Is that a correct analysis about the planning factors?

Captain MOORE. Yes sir. The decision was processed during the hearings last year and subsequently was made in early spring.

Mr. CROMWELL. That increases the total procurement plan to 83 airplanes which will buy out in fiscal year 1982 at the present six-a-year production rate. What is the force structure buildup that supports that planning figure?

Captain MOORE. This would support 4 aircraft in each of 12 squadrons which are assigned to the 12 carriers. It supports 8 aircraft in training squadrons, 2 training squadrons having 4 aircraft each, and—I don't have any numbers—I believe it is 11 aircraft in the pipeline and contemplated aircraft required to maintain force levels in the number of 16 to replace aircraft losses through attrition.

Mr. CROMWELL. What is the time period through which the advanced attrition buy is projected to cover? In other words, how long into the eighties would that provide enough E–2C's for an all E–2C force?

Captain MOORE. I believe the advanced attrition buy is to carry us into the 1990's, until the introduction of the V/STOL surveillance aircraft which would replace E–2C.

Mr. CROMWELL. Is there a specific calucation that the Navy uses as to loss rates and when you would run out because of attrition of the E–2C?

Captain MOORE. Yes sir. The attrition rate is 2½ percent. This would carry us to 1990.

Mr. CROMWELL. Will the Reserves get E–2C?

Captain MOORE. The current plan is to give the Reserves the E–2B and the Navy is studying at this time whether or not to give the Reserves the E–2C later in the mid-eighties.

Mr. CROMWELL. That could extend the E–2C program beyond 1983?

Captain MOORE. Yes sir. It would be necessary to buy approximately 10 additional aircraft to support the Reserves and the necessary pipeline and training to go with them.

E–2C PRODUCT IMPROVEMENTS

Mr. CROMWELL. What is the cost of the ARPS retrofit in the earlier E–2C's?

Captain MOORE. In fiscal year 1978 we are asking for $25.4 million to retrofit seven aircraft. It would cost approximately $3.6 million per aircraft.

Digitized by Google

Mr. CROMWELL. What would the total cost of that program be?

Captain MOORE. I don't have a total cost. I will have to get that for you.

[The information follows:]

The total cost of the ARPS retrofit program for 27 aircraft from fiscal year 1977 through fiscal year 1982 is $103.7M.

Mr. CROMWELL. Do you plan any other product improvements beyond the ARPS for the future?

Captain MOORE. Yes, sir, we do. We are now looking at changes that could be introduced into the aircraft, possibly beginning in fiscal year 1979 but the Navy is studying this problem at present and does not have firm plans.

Mr. CROMWELL. What kinds of improvements are you talking about?

Captain MOORE. We are considering upgrading the antenna for the radar. We are considering upgrading the computer. We have plans to improve the passive detection system to some extent to make it more capable of handling today's threat and projected threats. Other changes are minor and routine safety are flight type changes of less significance than those three.

INCREASE IN FISCAL YEAR 1978

Mr. CROMWELL. Why has your projected fiscal year 1978 budget increased $40 million since last year?

Captain MOORE. First of all, we had a significant reduction in the number of aircraft that we are buying this year amounting to a reduction from 11 aircraft to 6 aircraft. The 11 aircraft included 4 that we were buying for the Israelis. This constitutes a change in the base price of the aircraft of about $1.6 million each or total of $10 million. In addition to that, we have escalation and we have a change in Grumman business base.

Admiral TURNER. I have numbers on the increase of $40 million. The sume of $21 million is attributed as he indicated to five fewer aircraft being procured this year than last year. Add $7.2 million for escalation, $4.1 million for business base, $9.6 million for the five fewer aircraft, for a total of $20.9 million. The biggest expansion is the installation of the trainer on the west coast at Miramar to facilitate the transition from the E–2B to the E–2C on the west coast. As you know the E–2C squadrons have been based east and E–2B west. That would be $20.6 million for that trainer at Miramar and also to modify the Norfolk trainer to be compatible with the advance radar processing system which is being introduced into new production and subsequently retrofitted to older production.

Also, there are $2 million related to instructor or training and parts for the installation at Miramar and part of that is escalation involved in the ARPS installations. The total of the second category was $26.7 million. Add a long lead adjustment of $1.1 million, and spares of $8 million, for a net adjustment from 1978 to 1979 of $40.1 million. But in summary a smaller production base and the cost associated with the introduction of the E–2C on the west coast accounts for the increase.

Mr. CROMWELL. Thank you, Admiral. Thank you, Captain. That is all the questions I have.

Why don't we take up the A–6 program next? Here again we will put that in the record in the interest of time.

Digitized by Google

A–6E PROGRAM REVIEW

Captain ALEXANDER. Good morning, I am Captain Alexander, the A–6 project manager, and I will present the A–6 all-weather attack program.

A-6 ALL WEATHER ATTACK PROGRAM

AGENDA

- DESCRIPTION
  - A-6E AIRCRAFT
  - TARGET RECOGNITION ATTACK MULTISENSOR (TRAM)
  - KA-6D AIRCRAFT
- PROGRAM OVERVIEW
  - STATUS
  - INVENTORY
- PROGRAM FUNDING
- SUMMARY

This is the agenda for my presentation today.

The A–6 aircraft fills the Navy Department's need for a carrier based all-weather attack aircraft. The A–6E, our current model, has evolved from the basic A–6A airframe into the most effective attack aircraft in the world. The changes have principally been directed towards incorporation of modern, up-to-date navigation, communication and attack systems. For example, a new radar now combines, in one set, the former capability of both a search and track radar while a new digital computer provides a quantum improvement in both computer speed and reliability. The modification programs which I shall address later, will further improve the operational safety, reliability and maintainability of this complex weapon system.

A-6E MISSION

DESTRUCTION OF ENEMY TARGETS

- SHIPS, SHIPYARDS, PORTS, PORT FACILITIES, LAND BASED INSTALLATIONS
- CLOSE AIR SUPPORT
- INTERDICTION OF RAIL, ROAD, WATERWAY, AND SEABORNE TRANSPORTS
- ATTACK ENEMY TROOPS, FACILITIES AND ASSOCIATED SUPPLIES

ALL WEATHER OPERATION

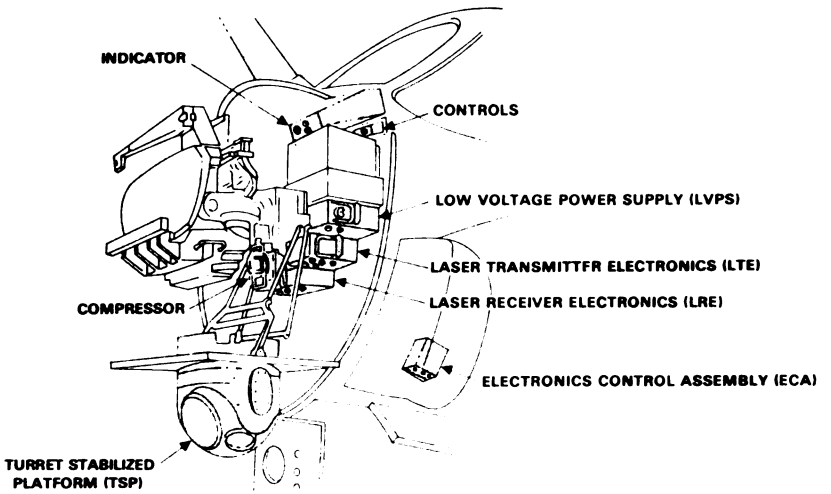
- DAY, NIGHT, INSTRUMENT OR VISUAL CONDITIONS

Digitized by Google

The A–6E mission is destruction of enemy targets under all-weather conditions, day or night. In Marine Corps operations, its mission is directed toward close air support, particularly at night and in bad weather. The aircraft system is optimized to destroy a wide variety of enemy targets.

The target recognition attack multisensor (TRAM) system further enhances the versatility of the A–6E by adding an unparalleled capability for night attack and identification of land and sea targets. The only difference in appearance when TRAM is installed is the small turret in the chin of the aircraft, shown in this photo. TRAM provides the aircrew with the ability to see at night and to autonomously deliver laser guided weapons. The system also improves unguided bombing accuracy because the aircrew can more accurately place the weapon system sensors on a target. The TRAM system is fully integrated into the aircraft weapon system and can passively acquire, identify and attack a non-radar significant target using its FLIR and inertial navigation system.

TRAM INSTALLATION



Shown here is the location of the TRAM equipments in the A–6E. The turret stabilized platform (the 20 inch dome) contains the three sensors of the TRAM system (FLIR, laser designator and ranger, and the laser energy receiver). The turret extends about 10 inches below the nose of the aircraft. Flight tests conducted in early 1976 have verified the operational suitability and performance of the TRAM pre-production systems.

This shows the TRAM installation, the right hand cockpit displays and an A–6E in a typical laser guided weapon delivery maneuver. The bombardier-navigator observes both the radar scope and the FLIR picture during the attack run-in. As the target becomes clear on the FLIR display, he shifts from the radar to the FLIR for precision tracking. Since the turret sweeps the full lower hemisphere below the aircraft, the pilot can maneuver freely after bomb release while the bombardier navigator keeps his laser designator pointed at the target for terminal weapon guidance. During the attack maneuver both the FLIR and radar presentation are recorded on a video tape recorder to allow for instant replay and bomb damage assessment as the flight crew egresses from the target.

Shown here refueling an A–6A is the KA–6D, our carrier based tanker. The aircraft is a modified A–6A. It has the capability of delivering 21,500 pounds of fuel and retains a secondary visual attack capability.

Digitized by Google

A—6 PROGRAM

STATUS

A-6E: PRODUCTION ON SCHEDULE.
PROGRAMMED THROUGH FY 1980.
CONVERSION IN LIEU OF PROCUREMENT ENDS FY 1978.
ALL SQUADRONS A-6E EQUIPPED BY SEPTEMBER 1977.

TRAM: TRAM LIMITED PRODUCTION ON SCHEDULE.
FULL PRODUCTION DECISION DECEMBER 1977.
PLANNED FLEET INTRODUCTION EARLY 1979.

KA-6D: CONVERSION IN LIEU OF PROCUREMENT REQUESTED.

I will now address the status of the A–6 program. Production and conversion in lieu of procurement programs are progressing well. All squadrons will be A–6E equipped by September 1977 and production is planned through fiscal year 1980. The A to E CILOP ends in fiscal year 1978 with 24 of our A–6A's being inducted. The TRAM system entered a limited production phase in July after a highly successful test and evaluation phase. The production decision scheduled in December will be based upon the results of an extensive TECHEVAL and OPEVAL utilizing systems in the production configuration. TRAM is planned for fleet introduction early in 1979. Conversion in lieu of procurement for KA–6D tankers is requested to maintain force levels. We plan to convert seven A–6A's to KA–6D's in fiscal year 1978 and the last three A–6A's to KA–6D's in fiscal year 1979.

A-6E INVENTORY (U)

INVENTORY

	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82
A-6E INVENTORY OBJECTIVE	[					]
BEGIN FY	[					]
A-6E PROD	+9	+5	+12	+15	+12	+6
A-6E CILOP	+31	+34	+30	0	0	0
OPERATING LOSSES	[					]
END FY	[					]
DELTA	[					]

REQUIREMENTS

A-6E INVENTORY OBJECTIVE	[ ]
USN SQDNS (12)	144
USN FRS* (2)	36
USMC SQDNS (5)	60
USMC FRS* (1)	14
OTHER	4
PIPELINE	49
FORCE LEVEL ASSURANCE	71
TOTAL PROCUREMENT (LOSSES TO DATE)	378 (11)

* FLEET REPLACEMENT SQUADRON

This chart depicts our A–6E inventory picture. The make up of our inventory objective is shown on the right under the requirements hearing. The programed

Digitized by Google

production through fiscal year 1980 will allow us to maintain our objectives through fiscal year 1985. Total procurement of 378 A–6E aircraft includes 138 new production and 240 A–6A to A–6E conversions. Total A–6E losses to date are eleven aircraft.

KA-6D INVENTORY (U)

	INVENTORY						REQUIREMENTS	
KA-6D INVENTORY OBJECTIVE	FY 77 60	FY 78 60	FY 79 60	FY 80 60	FY 81 60	FY 82 60	KA-6D INVENTORY OBJECTIVE	60
BEGIN FY	60	58	56	54	61	60	USN SQDNS (12)	48
KA-6D MODS	0	0	0	+9	+1	0	FRS* (2)	4
OPERATING LOSSES	−2	−2	−2	−2	−2	−2	PIPELINE	8
END FY	58	56	54	61	60	58	FORCE LEVEL ASSURANCE	20
DELTA	−2	−4	−6	+1	0	−2	TOTAL PROCUREMENT (LOSSES TO DATE)	60 (10)

* FLEET REPLACEMENT SQUADRON

This is a similar chart for the KA–6D tanker. As can be seen, the requested conversions will bring us back up to the level required through fiscal year 1981. The total procurement of 80 aircraft are all A–6A to KA–6D conversions. Losses to date are ten aircraft.

A-6E BREAKDOWN OF FY-78 FUNDS
($ IN MILLIONS)

ITEM		$	QTY
RESEARCH & DEVELOPMENT		4.1	0
MIL CONSTRUCTION		0	0
PROCUREMENT		157.9	12
ACFT & CHANGES	78.0		
GFE	59.9		
NON-RECURRING	0		
SUPPORT	31.0		
	168.9		
LESS FY-77 ADV PROC	− 11.0		
	157.9		
ADVANCED PROCUREMENT		20.5	
INITIAL SPARES		3.4	
PROGRAM COST FY 78		185.9	
PRIOR YEARS		1076.8	99
TO COMPLETE		400.9	27
TOTAL PROGRAM		1663.6	138

Digitized by Google

Turning now to program funding, this chart breaks down our fiscal year 1978 request for 12 A–6E aircraft and advanced procurement for next year's planned buy of 15 A–6Es. The R.D.T. & E. shown is primarily for commencement of the development of harpoon missile integration in the A–6E aircraft.

A-6 MODIFICATION PROGRAMS FY 1978

($ IN MILLIONS)

ITEM	DESCRIPTION	KIT QTY	COST
5-72	A-E CILOP	24	92.0
1-76	TRAM	26	32.3
3-77	AIR DATA COMPUTER IMPROVEMENT	149	0.4
7-72	AN/APN-194 RADAR ALTIMETER	29	1.0
9-77	CAINS	4	1.5
5-77	ELECTROLUMINESCENT WING TIP LIGHTS	100	0.2
2-75	CNI	20	2.2
7-77	SELF-RETAINING BOLTS	275	0.6
8-77	FUEL QUANTITY INDICATOR	24	0.2
1-78	VDI	60	3.2
103-69	KA-6D CILOP	7	13.6
20-74	KA-6D REWIRE	3	0.2
	TOTAL		$147.4
	RELATED INSTALLATION (O&M, N)		0.9
	RELATED INITIAL SPARES (AP, N)		14.8

This is the fiscal year 1978 A–6 modification program. The main effort remains the A–6A to A–6E conversion program. As indicated earlier, this is the last of our planned conversions. The last ten A–6As are planned for KA–6D conversions. The only new initiative is the vertical display indicator (VDI) which is primarily a reliability and safety improvement program. The initial spare costs are almost exclusively related to the tram program and represent the first increment of spares for this procurement.

SUMMARY

- A-6E PROGRAMS ON SCHEDULE
  - PRODUCTION THROUGH FY 1980
  - A-6A TO A-6E CILOP COMPLETE FY 1978
- TRAM IN LIMITED PRODUCTION
  - PRODUCTION DECISION DECEMBER 1977
- INTEGRATION OF HARPOON PLANNED
  - DEVELOPMENT COMMENCES FY 1978

Digitized by Google

In summary, the A–6 programs are progressing well. Planned production through fiscal year 1980 will maintain our force level through fiscal year 1985. TRAM production is anticipated in December and development of harpoon missile integration with the A–6E will commence this year.

Gentlemen, that concludes my brief.

A–6 PRODUCTION LINE GAP

Mr. CROMWELL. The first question is what were the costs to shut down the A–6E production line and start it up again, and how long a production gap was incurred.

Captain ALEXANDER. With the fiscal year 1977 buy of six aircraft we had a 9-month gap. We did not shut down the production line. The cost—I will have to supply that for the record. It is approximately a million dollars a month with a 9-month gap.

[The information follows:]

The current cost estimate for the fiscal year 1977 nine month gap is $1.0 million per month or $9.0 million. The fiscal year 1977 contract is presently under negotiation and will not be finalized until June 1977.

Mr. CROMWELL. In order to complete the record, was it a Navy recommendation that A–6E production be stopped in fiscal year 1976–77 time period or was it the recommendation from the Office of the Secretary of Defense?

Captain ALEXANDER. It was a decision from OSD.

Mr. CROMWELL. As I recall in prior years I believe this committee had added a long lead fund and in fact tried to keep their minds open in the past.

Captain ALEXANDER. Yes, sir.

A–6E INVENTORY PLANNING

Mr. CROMWELL. Now, why is the A–6E squadron UE going to go down to ten in fiscal year 1978 and then back up to 12 in fiscal year 1979? The A–6E UE is going down to ten in fiscal year 1978 due to the lack of aircraft, and fiscal constraints. In fiscal year 1979 there will be suffcient A–6Es.

Captain ALEXANDER. We have changed our finding. It is staying at UE of 12.

Mr. CROMWELL. Are you saying it is not going to go down to 10?

Captain ALEXANDER. It is going down to 10 in fiscal year 1978.

Mr. CROMWELL.. Earlier indications wre it was so. Would you explain what happened?

Captain ALEXANDER. With the new buy for fiscal years 1978–79 and 1980 our inventory requirement was such that we could meet for forward requirement with the new buy in fiscal 1978–79 and 1980. We have sufficient aircraft now to maintain a UE of 12 through 1984.

[The information follows:]

However, in fiscal year 1978, there will be insufficient A–6E aircraft to meet our UE of 12 aircraft per squadron. Therefore, for that year, the Navy will not be able to maintain a 12 UE in each Navy squadron.

Mr. CROMWELL. Your inventory calculations show you will go to a plus 20 excess airplane status by 1981 but then will start decreasing and will be back to even by 1985. That is if the present production

Digitized by Google

plan stops A–6E procurement after fiscal 1980. In light of earlier testimony today that the A–6E will remain in the Navy inventory until at least 1990, this raises the long-term issue of what production should be planned out into the eighties to support the A–6E force, and it also raises the question of whether A–6E squadrons should not be programed for the Reserves to build a wartime attrition base. Admiral Turner, would you comment on those questions?

Admiral TURNER. As you know, the A–6E production history has had its ups and downs. It is now on an up cycle of a 3-year program. There are no aircraft now presently planned for procurement in the last 2 years of the 5-year defense plan (FYDP). It is our intention to continue use of A–6E into the 1990's. Additional aircraft will be required at some point in time to continue the force levels in the medium attack squadron. That matter is being studied in Navy at this time and the number that will be required will be forthcoming. It is a significant number of aircraft for the outyears. Approximately 100 aircraft if we are going to maintain an all-A–6E force out through the 1990's.

Mr. CROMWELL. One hundred additional would be showing up in your procurement plans?

Admiral TURNER. In the last 2 years of the FYDP and beyond.

OPERATIONAL READINESS

Mr. CROMWELL. What are the operational readiness rates and the maintenance man-hours per flight-hour running on the A–6E and how do they compare with the A–6A?

Captain ALEXANDER. Operational readiness of A–6E has averaged 51 to 52 percent. Direct maintenance man-hours per flight-hour on A–6E is 31 hours. The direct maintenance man-hours per flight-hour for A–6E's is approximately one-half of that for the A–6A aircraft.

Mr. CROMWELL. Why is that? What factors cause it to be that way?

Captain ALEXANDER. It is because of the reliability that is being built into the new systems that are in the production A–6E's and being incorporated in the A-to-E modification.

Mr. CROMWELL. What is the average unit cost of the TRAM system?

Captain ALEXANDER. Under the limited production contract which is a letter contract, the unit cost is computed at $1.325 million.

Mr. CROMWELL. Under your total program buy what is the average cost?

Captain ALEXANDER. I will have to supply that for the record.

[The information follows:]

The average unit cost for the total program buy is estimated to be $1.320M.

Mr. CROMWELL. Thank you very much.

Can we take the RF–14 reconnaissance program?

Digitized by Google

Admiral TURNER. Captain Wright will speak on the RF–14 program.

Mr. CROMWELL. Would you put the statement in the record and let's go to questions.

[The prepared statement follows:]

RF–14 RECONNAISSANCE POD SYSTEM

INTERIM TACTICAL AIR RECONNAISSANCE POD SYSTEM

Good morning, Mr. Chairman: I'm Captain Wright, deputy project manager for the Navy interim tactical air reconnaissance system. The system being developed is a PODDED day, night, clear air mass system to be carried on an RF–14 aircraft. My brief will address force levels, mission requirements, system description and program milestones.

The force level required to fulfill Navy tactical air requirements has been established at 42 unit-equipped aircraft, predicated on sortie requirements anticipated in the most probable scenarios. Lack of these reconnaissance assets results in less cost effective application of attack sorties with the consequence of wasted missions and excessive combat attrition of aircraft and flight crews. At present the 42 U.E. level is being met by a combination of RF–8G and RA–5C aircraft. Both are plagued by obsolescent sensors, rising operating cost and decreasing availability. Phaseout has begun and is scheduled to accelerate through 1979 and 1980. Present plans provide for introduction of the POD-equipped RF–14s in [deleted.]

Digitized by Google

MISSIONS AND FUNCTIONAL REQUIREMENTS

	NAVAL MISSIONS		FUNCTIONAL REQUIREMENTS			
	SEA CONTROL	PROJECTION OF POWER ASHORE	RESOLUTION	COVERAGE	ASPECT	NAVIGATIONAL ACCURACY
TARGET DETECTION		X		X		
TARGET IDENTIFICATION	X	X	X		X	X
DEFENSIVE THREAT DETERMINATION	X	X		X		
WEAPON SELECTION SUPPORT	X	X	X		X	
WEAPON DELIVERY SUPPORT		X			X	X
DAMAGE ASSESSMENT	X	X	X			X

VIEWGRAPH 3

Reconnaissance missions including target detection, target identification, defensive threat determination, weapon selection support, weapon delivery support, damage assessment are shown as subsets of the naval missions of sea control and projection of power ashore. Functional requirements related to the reconnaissance missions define those system capabilities essential to completion of the overall reconnaissance mission. The first, resolution, may be roughly defined as the size of an object which can be recognized in imagery. Resolution requirements of [deleted] feet are common for precise identification of missile sites, vehicles, slips and communication sites. General identification requirements which enable target generation and weapon delivery support are less stringent ranging from [deleted] feet for vehicles to [deleted] feet for missile sites to [deleted] feet for ships. Coverage, which describes the ability to collect useable imagery over a given area, is directly dependent upon the aircraft range and the sensor's swath. Fleet pilots feel that the ability of a reconnaissance system to obtain imagery of the target from the same aspect that will be encountered during bombing runs greatly enhances target acquisition and recognition, thereby improving weapon delivery effectiveness. Association of accurate navigational and platform information with imagery provides the ability to rectify targets, make accurate measurements and to fully exploit collected information. Worldwide commitments of the naval mission accentuate the need of this capability for effective target generation, mission planning, execution and effectiveness assessment in widely ranging conditions.

Digitized by Google

TARPS

OPERATIONAL DESCRIPTION

- OPTICAL IMAGERY, DAY
  - PANORAMIC WITH RESOLUTION OF ONE GROUND FOOT TO 12,000 FEET
  - FORWARD OBLIQUE
- INFRARED IMAGERY, DAY AND NIGHT
- DATA ANNOTATION
- BUILT-IN TEST EQUIPMENT (BITE)
- COMPUTER ASSISTED NAVIGATION AND FLIGHT LINE ORIENTATION
- MINIMAL LIMITATION ON AIRCRAFT PERFORMANCE
- AIRCRAFT RECONFIGURED TO PHOENIX MISSION WITHIN 12 HOURS
- SIDEWINDER, SPARROW, AND GUNS CAPABILITY IN RECCE CONFIGURATION

VIEWGRAPH 4

Operational requirements which the RF-14 is being developed to satisfy are long-standing elements of tactical warfare. Cost and schedule considerations since 1974 have led to several iterations of the specific system to satisfy these requirements. The camera suite will provide day clear weather photography, both forward oblique, and panoramic coverage from horizon-to-horizon. Resolution suitable for precise identification will be obtainable at altitudes from "on the deck" to 12,000 feet. Clear air, night imagery suitable for taregt identification will be obtainable to [deleted] feet with target detection achievable well above that altitude. Data annotation will be provided on all imagery. Built-in test equipment is provided to the weapon replaceable assemblies level to reduce system turn-around time. Using existing F-14 computer assisted navigation, flight crews will be accurately directed to mission target locations and proper flight line orientation by appropriate heads up display (HUD) symbology. The POD and adapter interface have been designed to ensure minimum degradation of aircraft performance; currently estimated at 5 percent. Sidewinder, Sparrow and gun capability are retained in the reconnaissance configuration and, if full Phoenix mission capability is desired, the aircraft can be reconfigured within 12 hours.

Digitized by Google

[illegible] FUNCTIONAL REQUIREMENTS

[illegible]	[illegible]
[illegible]	[illegible]

[illegible]

[illegible] reconnaissance mission [illegible] targeting, target detection, target identification, defensive threat determination, weapon [illegible] support, weapon delivery support, damage assessment are shown as aspects of the naval mission of sea control and projection of power ashore. Functional requirements related to the reconnaissance mission define the system capabilities essential to completion of the overall reconnaissance mission. The first resolution may be roughly defined as the size of an object which can be recognized in imagery. Resolution requirements of [deleted] feet are common for precise identification of missile sites, vehicles, ships and communication sites. General identification requirements which enable target generation and weapon delivery support are less stringent ranging from [deleted] feet for vehicles to [deleted] feet for missile sites to [deleted] feet for ships. Coverage, which describes the ability to collect useable imagery over a given area, is directly dependent upon the aircraft range and the sensor's swath. Fleet pilots feel that the ability of a reconnaissance system to obtain imagery of the target from the same aspect that will be encountered during bombing runs greatly enhances target acquisition and recognition, thereby improving weapon delivery effectiveness. Association of accurate navigational and platform information with imagery provides the ability to rectify targets, make accurate measurements and to fully exploit collected information. Worldwide commitments of the naval mission accentuate the need of this capability for effective target generation, mission planning, execution and effectiveness assessment in widely ranging conditions.

Digitized by Google

TARPS

OPERATIONAL DESCRIPTION

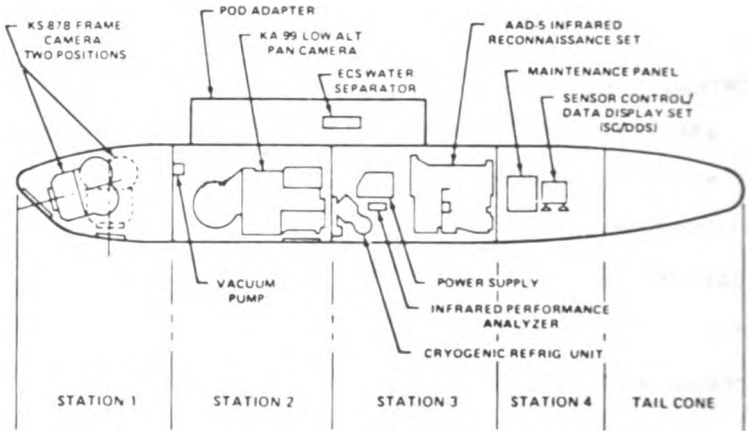
- OPTICAL IMAGERY, DAY
  - PANORAMIC WITH RESOLUTION OF ONE GROUND FOOT TO 12,000 FEET
  - FORWARD OBLIQUE
- INFRARED IMAGERY, DAY AND NIGHT
- DATA ANNOTATION
- BUILT–IN TEST EQUIPMENT (BITE)
- COMPUTER ASSISTED NAVIGATION AND FLIGHT LINE ORIENTATION
- MINIMAL LIMITATION ON AIRCRAFT PERFORMANCE
- AIRCRAFT RECONFIGURED TO PHOENIX MISSION WITHIN 12 HOURS
- SIDEWINDER, SPARROW, AND GUNS CAPABILITY IN RECCE CONFIGURATION

VIEWGRAPH 4

Operational requirements which the RF–14 is being developed to satisfy are long-standing elements of tactical warfare. Cost and schedule considerations since 1974 have led to several iterations of the specific system to satisfy these requirements. The camera suite will provide day clear weather photography, both forward oblique, and panoramic coverage from horizon-to-horizon. Resolution suitable for precise identification will be obtainable at altitudes from "on the deck" to 12,000 feet. Clear air, night imagery suitable for taregt identification will be obtainable to [deleted] feet with target detection achievable well above that altitude. Data annotation will be provided on all imagery. Built-in test equipment is provided to the weapon replaceable assemblies level to reduce system turn-around time. Using existing F–14 computer assisted navigation, flight crews will be accurately directed to mission target locations and proper flight line orientation by appropriate heads up display (HUD) symbology. The POD and adapter interface have been designed to ensure minimum degradation of aircraft performance; currently estimated at 5 percent. Sidewinder, Sparrow and gun capability are retained in the reconnaissance configuration and, if full Phoenix mission capability is desired, the aircraft can be reconfigured within 12 hours.

Digitized by Google

TARPS CONFIGURATION

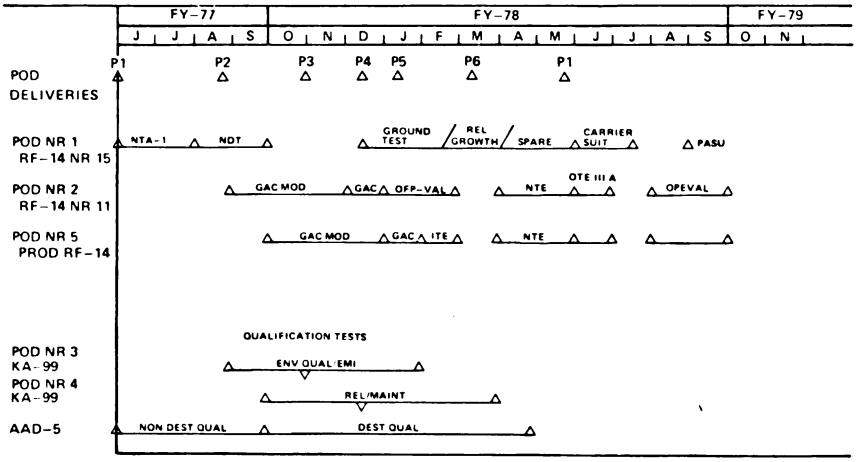


VIEWGRAPH 5

The TARPS pod is roughly the size of a 300 gallon drop tank and will weigh approximately 1250 pounds, two-thirds the weight of a full tank. Stable attachment to the RF–14 in the location of the aft, starboard phoenix station is achieved by an adapter integral to the pod. A KS–87 serial frame camera oriented in flight, either vertically or in the forward oblique position, is located in the first bay. This camera is presently used by the Air Force in the RF–4C and the U.S. Marine Corps in the RF–4B. The KA–99, a low to medium altitude panoramic camera, is housed in bay 2. This is the only new sensor being developed for this system. This camera provides flexibility, high resolution, variable target aspect, large area coverage, and a stand-off capability. Advances in microcircuitry and panoramic camera technology give this KA–99 significant advantages in weight, cube, warm-up time and reliability over existing fleet assets. An add-5 infrared line scanner with ancillary equipment is located in bay 3. Built for use by the U.S. Air Force, this system is used in the RF–4B and RF–4C and produces the highest quality imagery available among existing line scanners. In the last bay is the maintenance panel and sensor control/data display set. The SC/DDS combines functions of data annotation and camera control into one unit, thus saving space, weight and improving reliability.

Digitized by Google

TARPS T&E PLAN



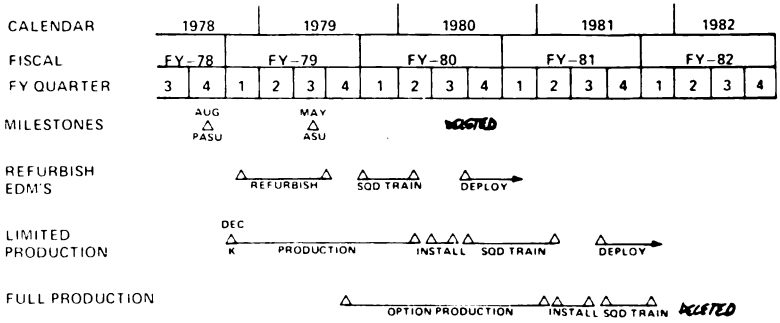
VIEWGRAPH 6

The TARPS program is approximately midway through its development cycle. A feasibility phase was successfully completed with flight tests aboard the USS America in March of 1975. Full-scale development was commenced in January of 1976 with Naval Air Development Center tasked to design and fabricate six prototype pods and Naval Weapons Center tasked to design, fabricate and install A-7E interface kits. The A-7E was at that time the intended primary reconnaissance aircraft. In September 1976, the F-14 was designated as primary platform and all A-7 interface was stopped. Efforts since that time have been towards an F-14 interface design. Work is progressing towards initiation of flight test this June. Pod fabrication is on schedule to interface with aircraft modifications during the first quarter of FY-78, additional pod assests will be used for reliability growth tests and environmental qualifications also scheduled at that time. Following flight test verification the Navy Technical Evaluation (NTE) will be performed. OPTEVFOR will fly 25 percent of these flights to provide justification for recommending provisional acceptance for service use and a limited production decision. OPEVAL will be performed after NTE is successfully completed.

88-370 O - 77 - 23

Digitized by Google

PRODUCTION & DEPLOYMENT SCHEDULE



LEGEND		
	PASU	PROVISIONAL APPROVAL FOR SERVICE USE
	ASU	APPROVAL FOR SERVICE USE
	IOC	INITIAL OPERATIONAL CAPABILITY
	K	CONTRACT AWARD

VIEWGRAPH 7

Production will commence with a limited production buy of eight systems. Options for full production buys in late fiscal year-1979 and fiscal year-1980 will be included in this first contractual effort. Following receipt of full approval for service use in May 1979, a go-ahead for full production will be sought. This production schedule will result in deployment of the first operational systems in late fiscal year-1980.

RF-14 RECCE POD PRICING FOR 49 AIRCRAFT

FISCAL YEAR	TQ & PRIOR	77	78	79	80	81	82	SUB TOTAL	TOTAL
RDT&E POD	7.7	5.7	9.1	4.8	--	--	--	27.3	27.3
APN-5 POD	--	--	4.5	25.7	18.1	--	--	48.3	
APN-6 SPARES	--	--	.2	3.0	3.1	--	--	6.3	
								54.6	54.6
RF-14									
APN-5 A/C MOD	--	--	--	30.0	22.9	--	--	52.9	
APN-6 MOD SPARE	--	--	--	1.2	3.3	--	--	4.5	
O&MN	--	--	--	--	.3	.5	.3	1.1	
								58.5	58.5
TOTALS	7.7	5.7	13.8	64.7	47.7	.5	.3		140.4

VIEWGRAPH 8

Digitized by Google

Total program costs of $140.4M (1977 dollars) include $27.3M RDT&E, $54.6M in pod, sensor and associated spares procurement; and $58.5M in aircraft spares, support and modifications. Fiscal year-1978 APN funding is required to procure peculiar ground support equipment for the pod and subsystems with sufficient lead time to enable FOT&E with production equipments and outfitting of tarps deployable carriers. Total APN funds of $59.9M in fiscal year-1979 and $47.4M in fiscal year-1980 will complete procurement of 52 pod systems and 49 aircraft mods.

PROGRAM RISKS

TECHNICAL – LOW

- DEGRADATION OF IMAGERY AT TRANSSONIC/SUPERSONIC SPEEDS
- ENVIRONMENTAL CONTROL

COST – LOW

SCHEDULE – MEDIUM

- SOFTWARE INTERFACE
- COMPACT TEST SCHEDULE

VIEWGRAPH 9

Technical and costs risk associated with this program are low. The only technical risks which are anticipated involve obtaining imagery at transonic/supersonic speeds and provision for a proper degree of environmental control. Early test flights have been designed to surface any unacceptable degradation in imagery as a result of shock wave phenomena. Analysis of any deficiencies should enable fixes to be effected without program slip. The environmental profile which will be representative of the RF–14 TARPS currently being analyzed. If it is determined that environmental control is required, a suitable system using FR–14 conditioned air available at the Phoenix station will be utilized. The rapidly deteriorating fleet reconnaissance posture has driven this program toward a very tight but achievable schedule, if the funds requested are provided.

This concludes my brief.

NAVY RECONNAISSANCE REQUIREMENTS

Mr. CROMWELL. This subcommittee in previous years has been very critical of the Navy's plan to use the A–7E as a reconnaissance airplane because of the slow speed and poor performance of the A–7E for that particular role. The F–14 seems like the only viable interim reconnaissance airplane until an RF–18 comes into the inventory in the mid-1980's. What sensors do the Air Force RF–4C and Marine RF–4B carry that the RF–14 will not have?

Captain WRIGHT. They have numerous cameras that are configured to be installed in a vertical position. I could more easily answer that by saying that we are using a serial frame camera in the RF–14 and the infrared line scanner in the RF–14 that are used in RF–4B and RF–4C.

Digitized by Google

Mr. CROMWELL. Do you have side-looking radar in the RF-14?

Captain WRIGHT. No, sir.

Mr. CROMWELL. Do you have any bad weather type of capabilities?

Captain WRIGHT. [Deleted.]

Mr. CROMWELL. How serious a deficiency is the lack of the SLAR capability? Is that a valuable reconnaissance asset for the Navy?

Captain WRIGHT. Yes sir, it has been stated as a requirement. The podded system being an interim system we are going with less than a full system as we have for a number of years in the RF-8.

Admiral TURNER. The reconnaissance program in the Navy has been at best a patchwork and I have been dissatisfied with the program as a fleet commander. At times I had assets, at times I did not. Sometimes they were one kind of aircraft, the next time something else. We are developing a long-range program which I had planned to speak to later, but will speak to now. That is to utilize the existing aircraft, the RF-8s and RA-5C until [deleted] and then to retire them finally and then to use the podded RF-14s in a detachment function, one detachment for each carrier, one main squadron to train and maintain capability. As you have indicated in your questions, there are some capabilities which are missing from the pod which we plan to utilize. There is ongoing study and investment toward a second pool to incorporate the side-looking radar and other desirable reconnaissance features.

However, it should be stated that while we have a working reconnaissance problem we have been developing quite capable systems in other aircraft that are rapidly coming into the inventory and fulfilling partly the reconnaissance functions that we desire. For instance, the TRAM, the FLIR, the navigation systems that are now in our aircraft are a quantum order of improvement over those of the period I was discussing earlier (some 5 years ago) in that the S-3, the A-7 and the A-6 now have capabilities of an all-weather nature to seek out and find, to reconnoiter and to report back the information which in many cases in the past was a province solely of the reconnaissance force. What I am saying is that our individual aircraft are developing capabilities which make us want to reassess the need for a totally dedicated whole new platform. I am pleased that I see coming in the RF-14 pod in conjunction with the advanced technology systems in our other aircraft, capabilities that we did not have even with our reconnaissance aircraft 4 or 5 years ago. We are also looking at a follow-on to the RF-14 pod program. We are looking at a derivative of the F-18 either as a pure RF-18 or an F-18 or 18 with pods that in conjunction with our existing equipments and systems will satisfy our reconnaissance requirements.

Mr. CROMWELL. Is the side-looking radar an over-water or an overland reconnaissance tool?

Admiral TURNER. Both. Primary application has been inland or coastal situation as far as I have personally been concerned.

Mr. CROMWELL. That was my impression from having heard the Air Force presentations here and also the Marine Corps and their capabilities. It does not do you too much good that you do not have a normal radar for targeting in the water, but certainly when you get into land warfare, side-looking radar is absolutely required.

Admiral TURNER. Yes.

Digitized by Google

Mr. CROMWELL. Would you provide a comparison of the performance of the RF–4 and the RA–7E, speed, survivability?

Captain WRIGHT. I will provide one, yes sir.

Mr. CROMWELL. Can you give us the top speeds right now?

Captain WRIGHT. At low level with RF–14 we are looking at sea level at [deleted] without the pod, I believe. I am not sure of the number on the A–7 but I believe somewhere near [deleted] knots.

Mr. CROMWELL. Will you provide the precise figures for the record?

Captain WRIGHT. Yes, sir.

[The information follows:]

There is presently an F–14 vulnerability assessment study being performed by the Naval Air Systems Command. The results of the study will be published in June 1977. The recent survivability improvements to the F–14 will have a significant impact on this study.

Survivability comparisons of the F–14 and A–7E have not been attempted. Top speed comparisons at sea level on a standard day indicate that the F–14's top speed with a reconnaissance pod is [deleted] knots. A podded A–7E under these conditions can achieve [deleted] knots.

Mr. CROMWELL. Would you outline the F-14 annual procurement plan required to support the current RF–14 squadron transition program? How many F–14's are intended for RF–14 role on a year-by-year fiscal year basis?

Admiral TURNER. I can answer that one. The procurement for the F–14, as you know, has been accelerated. Forty-four for 1978, 60 in 1979, 60 in 1980 and 42 in 1981. Of that 118 increase over the prior planning, 49 are devoted to and will be utilized in the reconnaissance role. Forty-two in in the squardron organized into 12 detachments of three each and seven in the pipeline. Does that answer your question?

Mr. CROMWELL. I was wondering how many in each fiscal year is required to support your buildup of the RF–14 squadrons?

Admiral TURNER. We have a slide that shows the introduction of the detachments year by year.

Mr. CROMWELL. I still don't think that will answer the question. You can supply that for the record. How many F–14's out of the fiscal 1978 budget are allocated to the RF program in 1979 and 1980?

Admiral TURNER. All right, sir.

[The information follows:]

Thirteen in 1978, [deleted] in 1979, and [deleted] in 1980. The [deleted] pipeline aircraft will be in 1981.

Captain WRIGHT. Current plans indicate two a month commencing in September of [deleted] with the last delivery in October of [deleted].

Admiral TURNER. The answer for 1978 is 13 out of the 44 are destined for the mission. The remaining years I will have to provide for the record.

Mr. CROMWELL. There appears to be a major gap in Navy reconnaissance capability in fiscal [deleted] time period. Will that gap be allowed to occur or is the Navy planning to prevent it?

Admiral TURNER. As I indicated, it is unsatisfactory at this point. There are some gaps and we are moving our forces to cover the deployed fleets as best we can. In essence there is coverage but it is barely adequate during this interim period. We are looking forward quite definitely to the introduction of the podded F–14. Here is the

Digitized by Google

program on this chart which indicates the aircraft by type, the TE and then the fiscal years across the top. The RF–8 detachments will be five in 1978, [deleted] in 1979, [deleted] in 1980, and [deleted] being retired by the end of fiscal year 1981. We have four RA–5C squadrons. They will be retired at the end of fiscal year 1980.

So you can see in, addition to the one Marine detachment of RF–4s, we can only cover in conjunction with Marine assistance [deleted] decks in 1978, [deleted] in 1979, [deleted] in 1980 and so forth. It is not until the RF–14 detachments arrive in significant numbers starting in [deleted] that we can reach out and cover all decks by [deleted]

Mr. CROMWELL. Is this a revised plan over what was presented earlier?

Admiral TURNER. That is correct.

EVENTUAL USE OF F–14 AIRPLANES

Mr. CROMWELL. What use will made of the RF–14s after a follow-on reconnaissance plane is procured?

Admiral TURNER. Reconnaissance versions of the F–14 will have their pods removed and then revert to F–14 squadrons as pure fighters. They are in essence the force assurance level for the fighter squadrons throughout that timeframe.

Mr. CROMWELL. Will the 49 RF–14s fill out the 24 squadron all F–14 fighter force after the follow-on reconnaissance plane is bought?

Admiral TURNER. No. They will not. Our total F–14 buy is 521. That is enough for 18 F–14 squadrons but will be enough also as these RF–14s return back into the inventory to allow a level of 20 to be maintained for 3 years at which time the level goes back down to 18 and will be maintained at 18 thereafter. Two squadrons that had been additionally provided F–14s for those 3 years will then transition into F–18s.

Mr. CROMWELL. Thank you. May we have the Navy RPV program.

Admiral TURNER. Speaking for the Navy RPV program is Captain Früchtenicht.

NAVY RPV PROGRAM

Mr. CROMWELL. In an effort to save time and to get on with the questions, we will place Captain Früchtenicht's complete statement in the record at this point.

[The prepared statement of Captain Früchtenicht follows:]

PREPARED STATEMENT OF CAPTAIN FRÜCHTENICHT

U. S. NAVY

OTH RPV

FOR

''ER-THE-HORIZON TARGETING

Digitized by Google

The remotely piloted vehicle project is a comparatively new program for the Navy. In 1975 and 1976 the Navy conducted a number of studies to define operational requirements for RPV's to perform specific missions. This included an independent evaluation of the Navy RPV program by the naval research advisory committee. These studies resulted in a decision last spring to orient the Navy's efforts toward an RPV to provide over-the-horizon targeting for the Navy's new inventory of surface-to-surface missile systems. The "OTH RPV" will of necessity be small to enable it to operate from surface ships of the frigate and destroyer class.

OVER-THE-HORIZON TARGETING REMOTELY PILOTED VEHICLE (OTH RPV)

REQUIREMENT: TO PROVIDE LOCALIZATION, CLASSIFICATION AND TARGETING INFORMATION TO HARPOON AND OTHER SURFACE TO SURFACE LAUNCH PLATFORMS

LOCALIZATION	LOCATE SUSPECT SURFACE CONTACTS PROVIDE INFORMATION ON OTHER TRAFFIC
CLASSIFICATION	IDENTIFICATION FRIEND, FOE OR NEUTRAL TYPE COMBATANT TARGET COURSE/SPEED
TARGETING	ACCURATE TARGET POSITION LASER ILLUMINATION POST DAMAGE ASSESSMENT

The basic requirement for the OTH RPV is to provide localization, classification and targeting information to Harpoon and other medium-range surface-to-surface launch platforms. The principal features that make the RPV attractive for this mission are its size and cost, and the fact that it is unmanned. The RPV can provide close-in identification of suspect targets without risking loss of comparatively expensive manned aircraft and priceless aircrews. In addition to providing positive identification of the contact, the RPV will provide the task force commander with necessary information to select the desired target. The RPV will also provide highly accurate target location data as well as information regarding tactics being employed by the enemy. This information, relayed by data link to the launch platform, will assist the task force commander in determining tactics to employ and will improve the mission effectiveness of the surface-to-surface missiles.

Digitized by Google

OTH RPV FORCE STRUCTURE

THE REQUIREMENT EXISTS FOR ALL SURFACE COMBATANTS

TENTATIVE PLANS CALL FOR OUTFITTING APPROXIMATELY D SHIPS WITH FOUR OTH RPV'S EACH:

FF	DDG
DD	CG
FFG	CGN

ALLOWING FOR ATTRITION AND TRAINING, TOTAL PROCUREMENT WILL BE 1500 RPV'S.

Present plans are for the OTH RPV to be deployed on all frigate class ships and larger, excluding aircraft carriers. These plans are, however, tentative and depend to a large degree on the results of the advanced development program. The advanced development program will include studies to refine the force composition requirement. For example, it may be more cost effective to outfit selected ships with the OTH RPV; these ships then providing over-the-horizon targeting for other members of the task force.

OTH RPV BUDGET

FIVE YEAR DEFENSE PLAN (FYDP)

	FY 77	FY 78	FY 79	FY 80	FY 81	FY 82
RDT&E	3.9M	4.8M	11.1M	17.1M	18.3M	19.4M

P.E. 63265N

NOTE: PRODUCTION WILL NOT COMMENCE UNTIL FY 84; THEREFORE PROCUREMENT IS NOT REFLECTED IN FYDP

Digitized by Google

As indicated by this chart, the RPV program shows a steady growth until fiscal year 1980, then begins to level off. The schedule depicted later in this presentation will reflect that initial contract awards for the OTH RPV will occur late this year. The expenditures through fiscal year 1978 are limited while high risk technology areas are addressed. It should be pointed out also that the advanced development phase will consist of a competitive fly-off between two contractors. This fly-off will occur in fiscal year 1981. The increase in fiscal year 1979 reflects the point wherein the contractors will commence fabrication and integration of the total system.

OTH RPV SYSTEM

- AIR VEHICLE
- AIRBORNE AVIONICS
- SHIP FACILITIES
- SHIPBOARD ELECTRONICS

When referring to the OTH RPV, we are concerned about the total system, including ground equipment and payloads. The OTH RPV system can be divided into four identifiable sub-systems.

The air vehicle itself is comprised of the airframe, engine, flight control systems and basic communications equipment.

The airborne avionics are the sensors and electronics packages necessary for accomplishing the classification and targeting functions.

Ship facilities include the launch and recovery equipment, test equipment and other ground support equipment.

Finally, shipboard electronics deals with integration of the RPV into the ship's system. The RPV control console and data receiving station is included in this sub-system.

Digitized by Google

DESIGN AND PERFORMANCE PARAMETERS

	GOAL	THRESHOLD
VEHICLE WEIGHT	200 LB	300 LB
RADIUS OF ACTION		
TIME ON STATION	DELETED	
DASH SPEED		
OPERATIONAL AVAILABILITY		
DESIGN-TO-COST	$140,000	$170,000

Design and performance parameters have been defined for the OTH RPV. One of the major goals for the program is to keep the RPV as small as possible. This is necessary to ensure the vehicle is usable on board the ship. High reliability and good maintainability are required to minimize manning requirements. Storage and portability are other factors being considered. In recognition of the weight and size limitations on the RPV, the performance goals are being selected on the basis of minimum performance to accomplish the mission. The reduced performance goals will also play a significant role in keeping R&D costs as well as production costs as low as possible.

TEST AND EVALUATION

EXTENSIVE TEST AND EVALUATION SCHEDULED AS PART OF ADVANCED DEVELOPMENT COMPETITIVE FLYOFF PROGRAM.

- EMPHASIS ON SHIPBOARD COMPATIBILITY AND MISSION PERFORMANCE
- TESTING WILL INCLUDE CONTRACTOR AND NAVY "HANDS ON" TESTING

TESTING TO DATE PRIMARILY RELATED TO SELECTION OF SUITABLE METHOD OF RECOVERY

Digitized by Google

The Navy intends to conduct an extensive test and evaluation of this system prior to full scale development. There are two factors that dictate this approach. The OTH RPV represents a number of new technologies including the air vehicle itself, the airborne avionics and the recovery system. These technologies require thorough assessment. Shipboard compatibility also requires extensive evaluation. In fact, shipboard compatibility is considered just as important as mission performance.

The Navy's fiscal year '76 and '77 program also includes test and evaluation with emphasis on evaluating methods of recovering RPV's aboard surface ships.

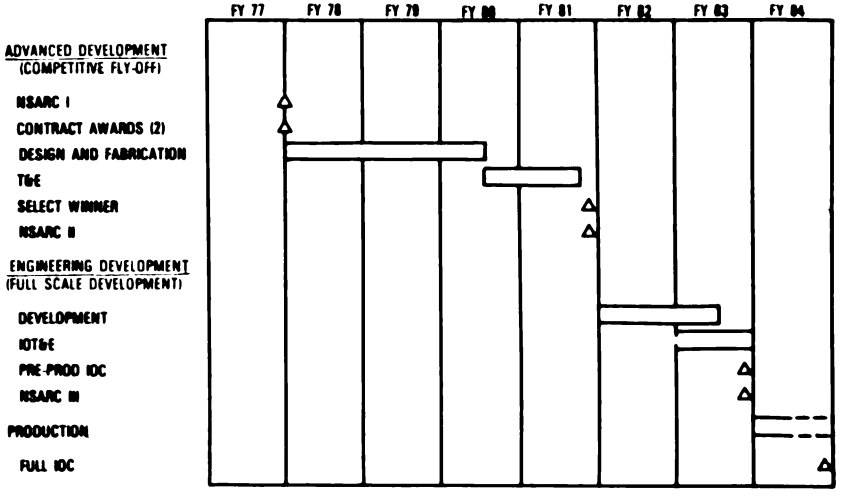
Significant progres has been made in the past year in the selection of a suitable recovery technique for the OTH RPV. The results on the net recovery technique are particularly encouraging. The Navy has accomplished some testing using this system, and the Army has had excellent results using a net system to recover their RPV's. Test results indicate that even allowing for ships motion, an RPV can consistently recover into a net.

Digitized by Google

Although the net system appears to be a suitable method of recovery, the Navy is evaluating other methods as well. Through sponsorship of the joint technical coordinating group for RPV's, the three military services are evaluating the use of parafoils or deployable fabric wing devices which reduce recovery speeds to the twenty to thirty knot regime. The test program has been very successful to date.

Industry proposals for development of the OTH RPV may include alternate methods of recovery. Having now established a baseline recovery technique, we are in a position to evaluate other concepts.

OTH RPV PROGRAM PLAN



Digitized by Google

The Navy's program plan for RPV's is in accordance with existing directives. In the first phase, we will conduct an advanced development fly-off between two competing contractors. Upon selection of a winning contractor we will enter into full scale development and ultimately into production. The projected operational capability date is 1984.

PROBLEM AREAS

1. OFF-THE-SHELF EQUIPMENT NOT AVAILABLE. OTH RPV REPRESENTS SIGNIFICANTLY NEW WEAPONS SYSTEM MERGING MISSILE AND MANNED AIRCRAFT TECHNOLOGY. SHIPBOARD CONSTRAINTS NECESSITATE MINIATURIZATION OF ELECTRONICS AND INNOVATION IN SYSTEM DESIGN.

2. FYDP WILL REQUIRE ADJUSTMENT IN FY 79 AND FY 80. AMOUNT OF INCREASE DEPENDENT ON CONTRACTOR PROPOSALS.

It is recognized that the Navy is pushing the state of the art in development of the OTH RPV. This means the risks in the early phases of the program are higher than we would like. The program is structured so that the higher risks areas are addressed early in the development phase.

The technology being introduced in this program will have wide application to other RPV programs, as well as manned aircraft and missile systems. Considering the mission requirement and the benefits derived from the RPV technology, the risks are reasonable.

Navy costs estimates for the advanced development phase of the program indicate a funding deficit may occur in fiscal years 1979 and 1980. This is caused partially by the decision to proceed with a competitive fly-off. It is recognized that this approach costs more in the early part of the program, but saves money in the long run, and increases probability of success. The funding problem is presently being addressed and will be resolved prior to committing large expenditures of monies.

PAST NAVY EFFORTS

Mr. CROMWELL. Captain, how much has been spent through fiscal year 1977, and what has been accomplished in the Navy over the horizon of the RPV program?

Captain FRÜCHTENICHT. Approximately $5.4 million, sir. That includes funding in 1977.

Mr. CROMWELL. What are the accomplishments in the program.

Captain FRÜCHTENICHT. Specifically we have done a number of studies but the major effort has been in developing a recovery system for RPV applicable to surface ships.

Mr. CROMWELL. What sensors will that RPV carry?

Captain FRÜCHTENICHT. It will include a radar system. We are looking at small lightweight radar, 20- or 25-pound category. It will also include an IR system—infrared system—which again would be in the 20- to 25-pound category. These are the two primary sensors it will carry.

Digitized by Google

Mr. CROMWELL. Has any testing been done to date to evaluate the ability of RPV to do ocean surveillance?

Captain FRÜCHTENICHT. Not on this specific mission, no sir.

Mr. CROMWELL. Will such testing be done before going into a competitive design prototype phase?

Captain FRÜCHTENICHT. We will be doing testing in a buildup throughout that period of time. No sir, the program does not call for a feasibility demonstration.

Mr. CROMWELL. Why won't the Navy go out and find out if this is going to work before they start building competitive prototypes?

Captain FRÜCHTENICHT. There is a major decision in that factor primarily related to size of the RPV. We could not test the feasibility of an RPV to do the mission without also testing feasibility of RPV to be able to live on board a surface ship. This is pretty well what the advanced program is trying to solve as far as these two questions.

Mr. CROMWELL. I understand how you are solving the problem of recovering the RPV back on the ship. I don't see why the Navy is not going to examine whether or not it is operationally useful to send an RPV over the horizon to do ocean search, looking for targets. Certainly if you go back to the experience with the Navy Condor which had a television seeker, I know the difficulties that the operators had in finding a ship on the ocean with the Condor system even when they knew approximately where it was before they launched the missile. Shouldn't this major question be answered before you start developing prototypes, that is the thrust of my question.

Captain FRÜCHTENICHT. It was desirable to do a major demonstration on this prior to launching a major procurement, yes sir.

Mr. CROMWELL. Would you give us for the record how long that would take, that kind of demonstration, feasibility demonstration program and how much it would cost in fiscal year 1978?

Captain FRÜCHTENICHT. I will have to supply that for the record, sir.

[The information follows:]

Investigation reveals that the over-the-horizon targeting mission, using an RPV, has, in fact, been demonstrated. [Deleted]

This exercise was an accurate and successful concept feasiblity demonstration of the over-the-horizon RPV mission. [Deleted]

The Navy now has confiidence that an RPV can operate from aviation capable ships, and through the various concept feasibility efforts, has adequately demonstrated the over-the-horizon RPV mission. The Navy program is now entering the concept validation phase wherein an RPV is designed to be both shipboard compatible and mission capable. The program includes appropriate test-bed demonstrations as the system is developed.

The Navy will develop the OTH concept with continued feasibility demonstrations utilizing an appropriate testbed configured with small radar, EO, and data link systems and being flown as an RPV. These demonstrations will cost less than $100,000 and will be completed in 6 months. This will not impact on the current program schedule.

Senator TOWER. Admiral Turner, I believe your presentation on the Sixth Fleet was interrupted. Would you continue that?

Admiral TURNER. Yes, Senator Tower.

Digitized by Google

SIXTH FLEET OPERATIONS BRIEFING

I was describing the operation of the Sixth Fleet during the time-frame October-November 1973, the Yom Kippur war and I had organized my talk into three phases, the initial actions incident to the war and movements of the naval forces out into the Mediterranean, a secondary phase which was marked by a great deal of prolonged hostilities on land and an enormous resupply airlift effort on the part of the United States and also the Soviets doing the same thing and in the third phase, a naval confrontation which began on the first of November. When the United States went to defense condition three. At that time there were approximately 96 Soviet ships in the Mediterranean and there were 67 U.S. naval vessels. Most of those ships were in close proximity to each other. We had discussed the tactics employed by the U.S. forces to be prepared to carry out their mission whatever it might be, but specifically to evacuate U.S. nationals from any of the Mediterranean ports if directed regardless of any opposition, to influence the events in the area, and insofar as possible make U.S. presence felt in our efforts to bring about a cease fire.

I have gone through all the tactics. I was coming up to a few incidents which took place which will be of interest.

[Deleted.]

During this period Secretary Kissinger flew back and forth to the Middle East in his historic peace efforts. In one of them he came out of Moscow moving to Israel [deleted].

Finally the efforts were over. The peace efforts were successful. The forces began to disperse and the Yom Kippur war came to a halt.

Many lessons were learned from all of this. First of all, the Sixth Fleet was able to act effectively as an instrument of national policy. It was prepared to carry out all of its missions and even though confronted with a [deleted] array of opposing naval power it was my conviction that I could have carried out all of my missions despite their presence. It would have been a very serious and costly endeavor but it could have been done. What made it work was carrier based naval airpower which was able to predominate throughout the Mediterranean. It provided invaluable assets and resources which were capable of maintaining control of the undersea, the surface and the air picture. Another big lesson was in the rapidity with which the Soviets introduced a new fleet in the Mediterranean. As I indicated earlier in my remarks some years before there were very few Soviet naval vessels in the Mediterranean. One or two. In the short space of 12 to 15 years the Soviets produced a whole new fleet and put it in the Mediterranean. It did inhibit the U.S. choices. It did inhibit the U.S. options. It did create a Soviet presence which undoubtedly reduced the effectiveness of our presence and our influence. Nevertheless, our carrier airpower was the dominant element and enabled us, as it does today whether in a crisis situation or in a wartime situation, in my view, to carry the day.

There are other valuable lessons in terms of Soviet tactics and weapons systems. I have been over those. [Deleted.]

Digitized by Google

Also we must provide him with weapons and forces which enable him to be immediately responsive and to act spontaneously to a hostile situation, so that he can then carry out his other missions.

Introduction of the Soviet Navy in the Mediterranean has had a significant impact on the balance of power in the Mediterranean. From our point of view it has been a most unfavorable impact. We need to continue to update our forces if we are going to maintain that effective presence, that military capability which has enabled the U.S. Sixth Fleet to be such an eminently successful instrument of national policy.

That completes my remarks on the Sixth Fleet operations during a very trying time, a significant time, October–November 1973.

Senator TOWER. Thank you very much.

Mr. CROMWELL. Can we take up the A–7 now?

Admiral TURNER. Captain Dunning is project manager for A–7 airplane and will, as you directed earlier, submit his statement for the record and is prepared to answer questions on the aircraft.

Senator TOWER. Do you have a statement to make first, Captain?

Captain DUNNING. I have an abbreviation of my statement.

Senator TOWER. Why don't you make your abbreviated statement?

A–7E PROGRAM REVIEW

Captain DUNNING. My name is Captain Dunning, the A–7 program manager, and I work at the Naval Air Systems Command.

The A–7 is the Navy's current light attack aircraft. It was the first light attack aircraft to have a computer controlled weapons delivery and navigation system. The forward looking infrared is now being added. This aircraft was operational in April 1970 and is capable of carrying practically all types of conventional ordnance while performing tactical air support and interdiction missions. The aircraft is also capable of carrying tactical nuclear weapons.

COMPUTER CONTROLLED WEAPONS DELIVERY/NAVIGATION SYSTEM

- "HEAD UP" DISPLAY
- CENTRAL DIGITAL COMPUTER
- INERTIAL PLATFORM
- PROJECTED MAP DISPLAY
- FORWARD LOOKING INFRARED

Digitized by Google

The A–7 program office manages four major programs. The annual procurement of the A–7E, the development and procurement of the A–7E forward looking infrared (FLIR) system which provides an integrated, see at night, heads up display, night attack capability, the conversion of older model A–7B's and A–7C's to a two-seat TA–7C trainer, and a foreign military sales case which provides 60 A–7H aircraft to Greece. Fifty-three of these A–7H airplanes have been delivered and are operational. A sales case of 110 aircraft is pending for Pakistan.

I would like to discuss the first three programs as procurements and modernizations and follow with a report on the TF–41 engine situation.

The A–7E inventory requirement through fiscal year 1983 is [deleted] airplanes. This is required to maintain an all A–7E active force until introduction of the A–18. This requirement supports 12 aircraft carriers, fleet readiness squadrons, research and development, and pipeline.

1-15-77

A-7E INVENTORY REQUIREMENT
(FY 79 THROUGH FY 83)

FLEET SQUADRONS	DELETED
READINESS SQUADRONS	
OTHER	
PIPELINE	
TOTAL	

Termination of the procurement program in fiscal year 1978 falls short of achieving this goal by about 36 aircraft.

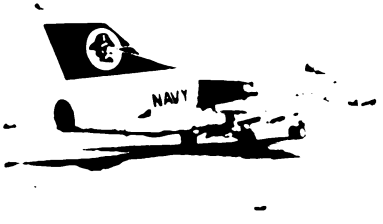
The fiscal year 1978 procurement request is for required A–7E support. The fiscal year 1979 funds will be for line shutdown and continued A–7E support.

Digitized by Google

TOTAL A-7E PROGRAM

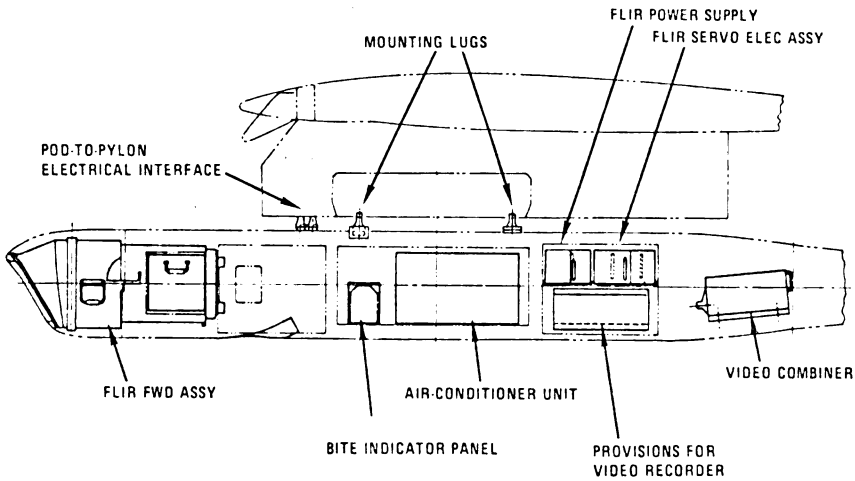
	FY 1977 AND PRIOR	FY 1978	FY 1979-1982	TOTAL
QTY	572	0	0	572
NET P-1	1859.8	21.0	16.7	1897.5

The fiscal year 1977 program for 30 aircraft included funds for the A–7E forward looking infrared system. This system uses a pod on the right wing of the aircraft in which the infrared receiver and associated electronics are located. The pod also contains a power supply and servo electronic assembly which provides power and pointing signals to the FLIR. A video combiner receives the signals from the infrared set, combines them with the weapons delivery symbols in the heads up display, and transmits both to the heads up display as a television image. A built-in test indicator panel tells the maintenance personnel which component is faulty, and an air-conditioner cools the equipment. The pod also has provisions for a video recorder.



Digitized by Google

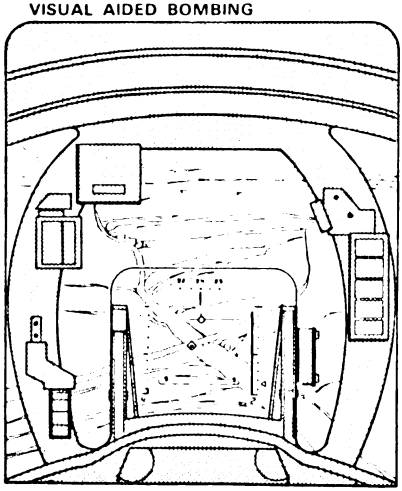
POD GENERAL ARRANGEMENT



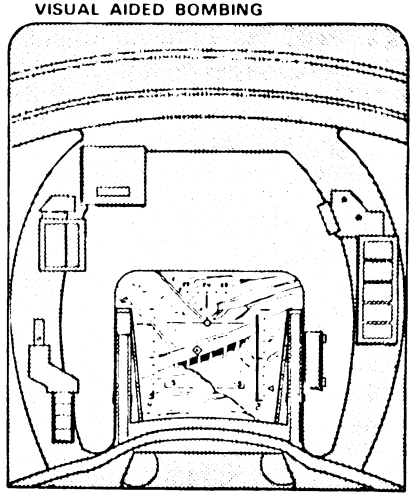
In the daylight mode, the pilot has a full range of visual capability. The heads up display projects navigational information, piloting information, and weapons system delivery information. At night the pilot loses the visual panorama but is provided a television-like image by the infrared system which is combined with the same heads up display symbols and thus a night attack capability. The system requirements essentially give the pilot the same capability, within the acquisition window as in daytime.

A-7E FLIR SYSTEM OBJECTIVE

EXISTING DAY SYSTEM
VISUAL TARGET RECOGNITION
VISUAL AIDED BOMBING



FLIR NIGHT SYSTEM
VISUAL TARGET RECOGNITION
VISUAL AIDED BOMBING



Digitized by Google

A-7E FLIR PROGRAM CHRONOLOGY

● JUN 72	REQUIREMENTS ESTABLISHED (SOR 11-96)
● NOV 72	VOUGHT CONTRACT FOR TWO FULL SCALE R&D PROTOTYPES
● JUN 73	FLIR VENDOR CHANGED FROM HUGHES TO TEXAS INSTRUMENTS
● JUN 75	FIRST FLIGHT
● JUL 75	NAVY TECHNICAL ASSESSMENT COMPLETE
● NOV 75	CONTRACTOR TEST COMPLETE
● MAR 76	NAVY TECHNICAL EVALUATION COMPLETE
● SEP 76	SIX PREPRODUCTION PROTOTYPES ON CONTRACT
● OCT 76	OTIIIB (IOT&E) COMPLETE
● JAN 77	LIMITED PRODUCTION APPROVED

The A–7E FLIR program started in 1972. It has progressed successfully through all test and evaluation milestones. Six preproduction prototypes were ordered in September 1976 and limited production was commenced in January 1977 subsequent to Navy Department review. The system met or exceeded all performance, reliability and maintainability requirements during the OTIIIB (IOT&E) OPEVAL in October 1976.

I would like to show you a movie of the results we have at this time. The movie is taken from a video recorder which records on video tape and is replayed for filming on a screen. The scenes are taken from actual tests and of course are the best we can show you. They are very good. They are shown in this room at a slight disadvantage because of the translucence of the screen and the ambient light level. I will comment on the movie. We may be able to hear the sound of the pilot transmitting what he sees at the same time.

We have to realine the movie. Can I continue and come back to it?

Senator TOWER. I trust the infrared system in the A–7 works better than this one.

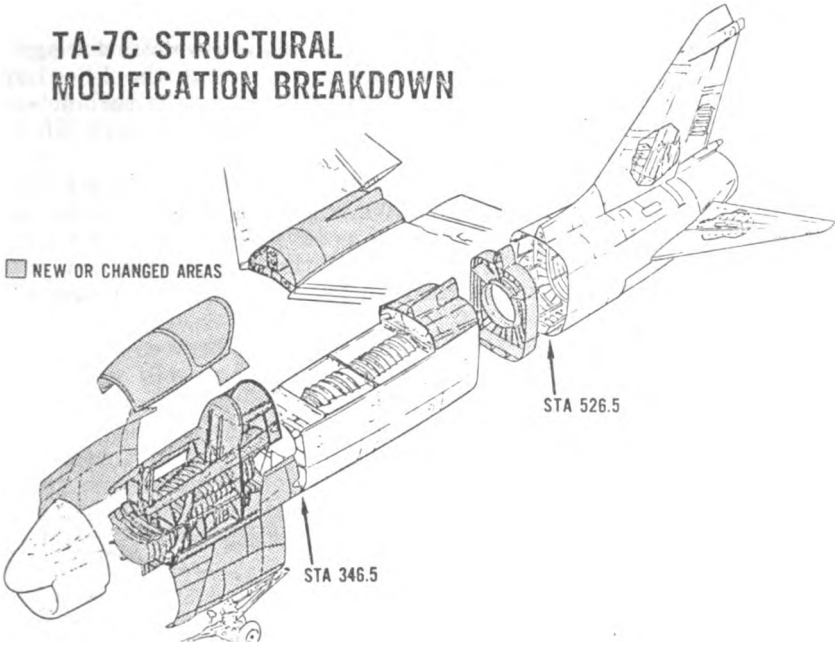
Captain DUNNING. Yes, sir.

Senator TOWER. Go ahead and we will come back to it.

Captain DUNNING. The A–7 FLIR system is being procured on the basis of one pod for each two aircraft. The chart shows the inventory and deployment plan which introduces the system to the fleet in July 1978 for deployment in September 1979. The constant inventory during fiscal year 1979–80 recognizes the lack of funds in fiscal year 1978 caused by recent program decisions. Full production will commence following operational evaluation in early fiscal year 1979.

The two seat, TA–7C, conversion program is now well underway. This program converts the aircraft by making it 34 inches longer, adding a two-seat cockpit, a side opening canopy and a new wing fairing section. The aircraft will have the full A–7E weapons system as well as specialized weapons system training aids.

Digitized by Google



We have inducted 24 A–7B's and 11 A–7C's. The first flight of a converted airplane was made in December 1976 and the operational evaluation will be completed by August 1977. Deliveries to the fleet will commence in the summer of 1977. The program was reduced in fiscal year 1977 from 81 to 65 aircraft as a result of reprograming actions and in recognition of the need for some A–7E's to remain in the fleet readiness squadrons. We are requesting $33.2 million for the conversion of 14 aircraft in fiscal year 1978.

TA-7C PROGRAM

	FY 74	75	76/T	77	78	79	80	TOTAL
INDUCTIONS		3	28	15	14	5		65
DELIVERIES				14	24	14	13	65
COST	4.8	31.3	85.4	34.4	33.2	18.6		207.7

1-15-77

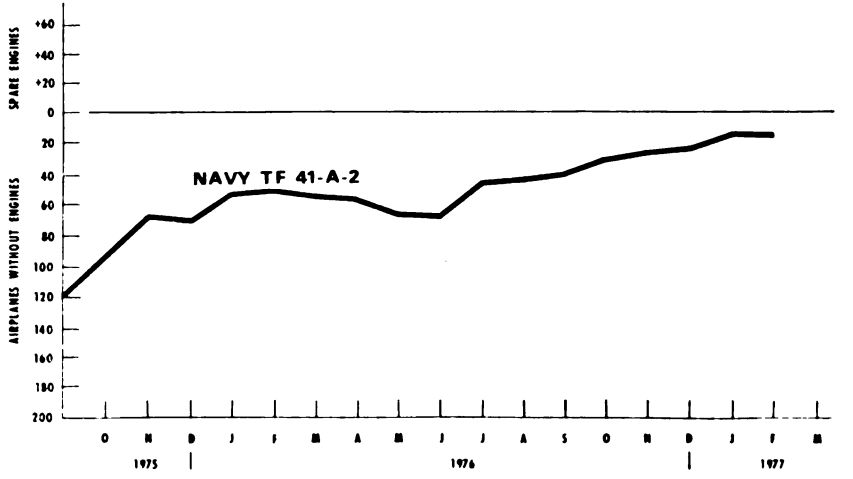
Digitized by Google

The A–7 material readiness has been between 55 to 60 percent this past year.

The TF–41 engine has been our greatest readiness detractor again this year. As reported last year, the main problem in the TF–41 results from higher than anticipated temperatures in the turbine section, installation of unsuccessful fixes, and the expiration of life on certain turbine parts.

Our lowest readiness condition existed in September 1975 when we had approximately 120 aircraft without engines. The position has improved steadily and we are in a very good position now. We show on the slide about [deleted] airplanes without engines but I have some 37 ready for issue engines and we have a float in this relation.

A-7 ENGINE READINESS



The TF–41 improvement program has developed several new fixes which will allow us to return to unrestricted engine operations. These new engine fixes have undergone more abusive testing in the laboratory than ever before through specifically designed tests to consider actual fleet use. The new components have over 600 hours of this testing in the laboratory where they were getting only 150 hours in the past. We are also flying these parts in an accelerated service test engine and we have accumulated over 150 hours on this engine. In April of this year, a 30 engine set will be introduced and we plan to accumulate 225 hours on these engines before we commit the entire fleet to the change. This new systematic approach is now being followed on an annual basis vis-a-vis the TF–41 engines. I would like now to try again on the infra-red film.

[Film followed.]

Digitized by Google

NARRATION OF FILM

Captain DUNNING. He is making a run on a bridge. You will be able to see a vehicle on the bridge. You will be able to see fairly good definition along the coast here.

This is an aiming diamond which with the bomb release line should be able to put the bomb on target.

Mr. CROMWELL. Was that taken at night?

Captain DUNNING. This was taken at night at roughly 2 o'clock in the morning on one of the coldest nights we could find and under ideal weather conditions. This is the POL storage. This picture is clear enough to see the [deleted]. This diamond shows the distance to the target. [Deleted] Pilot is at 11,000 feet. [Deleted.] This is a maneuver demonstrating if he veers away from the target and back the aiming diamond will be on the target again for a second run. It is a little over 90 degree angle of bank in the dark. [Deleted.]

I have covered the requirements of the two major programs that are ongoing in the A–7 community, and the readiness. In summary we are requesting $21 million in fiscal year 1978 funds for A–7E support and we are requesting $52.2 million for fiscal year 1978 APN–5 funds for A–7 modifications including $33.2 for the two seat TA–7C conversions.

Thank you.

A-7E FY 78 BUDGET SUMMARY

$21.0M FOR CONTINUING SUPPORT

$52.2M FOR MODIFICATIONS INCLUDING TWO-SEAT CONVERSIONS

Digitized by Google

[The prepared statement follows:]

PREPARED STATEMENT OF CAPTAIN DUNNING

I am Captain Dunning, the A-7 program manager at Naval Air Systems Command.

The A-7E is the Navy's current light attack aircraft. It was the first light attack aircraft to have a computer controlled weapons delivery and navigation system with elements indicated on the slide.

COMPUTER CONTROLLED WEAPONS DELIVERY/NAVIGATION SYSTEM

- "HEAD UP" DISPLAY
- CENTRAL DIGITAL COMPUTER
- INERTIAL PLATFORM
- PROJECTED MAP DISPLAY
- FORWARD LOOKING INFRARED

The forward looking infra-red is now being added. This aircraft was operational in April 1970 and is capable of carrying practically all types of conventional ordnance while performing tactical air support and interdiction missions. The aircraft is also capable of carrying tactical nuclear weapons.

The A-7 program office manages four major programs. The annual procurement of the A-7E, the development and procurement of the A-7E forward looking infra-red (FLIR) system which provides an integrated, see-at-night, heads-up-display, night attack capability, the conversion of older model A-7B's and A-7C's to a two-seat TA-7C trainer, and a foreign military sales case which provides 60 A-7H aircraft to Greece. Fifty-one of these A-7H airplanes have been delivered and are operational. A sales case of 110 aircraft is pending for Pakistan.

Digitized by Google

A7E PROGRAM

- REQUIREMENTS
- MAJOR EFFORTS
  - FORWARD LOOKING INFRA-RED
  - TWO-SEAT CONVERSION
- READINESS

I would like to discuss the first three programs as procurements and modernizations and follow with a report on the TF 41 engine situation.

The A–7E inventory requirement through fiscal year 1983 is [deleted] airplanes. This is required to maintain an all A–7E active force until introduction of the A–18. This requirement supports 12 aircraft carriers, fleet readiness squadrons, research and development, and pipeline.

Termination of the procurement program in fiscal year 1978 falls short of achieving this goal by about 36 aircraft.

TOTAL A-7E PROGRAM

	FY 1977 AND PRIOR	FY 1978	FY 1979-1982	TOTAL
QTY	572	0	0	572
NET P-1	1859.8	21.0	16.7	1897.5

Digitized by Google

The fiscal year 1978 procurement request is for required A–7E support. The fiscal year 1979 funds will be for line shutdown and continued A–7E support.

The fiscal year 1977 program for 30 aircraft included funds for the A–7E forward looking infra-red system. This system uses a pod on the right wing of the aircraft in which the infra-red receiver and associated electronics are located. The pod also contains a power supply and servo electronic assembly which provides power and pointing signals to the flir. A video combiner receives the signals from the infra-red set, combines them with the weapons delivery symbols in the heads-up display, and transmits both to the heads-up display as a television image. A built-in test indicator panel tells the maintenance personnel which component is faulty, and an air conditioner cools the equipment. The pod also has provisions for a video recorder.

In the daylight mode, the pilot has a full range of visual capability. The head-up-display projects navigational information, piloting information, and weapons system delivery information. At night the pilot loses the visual panorama but is provided a television-like image by the infra-red system which is combined with the same heads-up-display symbols and thus a night attack capability. The system requirements essentially give the pilot the same capability, within the acquisition window as in daytime.

A-7E FLIR PROGRAM CHRONOLOGY

- JUN 72 — REQUIREMENTS ESTABLISHED (SOR 11-96)
- NOV 72 — VOUGHT CONTRACT FOR TWO FULL SCALE R&D PROTOTYPES
- JUN 73 — FLIR VENDOR CHANGED FROM HUGHES TO TEXAS INSTRUMENTS
- JUN 75 — FIRST FLIGHT
- JUL 75 — NAVY TECHNICAL ASSESSMENT COMPLETE
- NOV 75 — CONTRACTOR TEST COMPLETE
- MAR 76 — NAVY TECHNICAL EVALUATION COMPLETE
- SEP 76 — SIX PREPRODUCTION PROTOTYPES ON CONTRACT
- OCT 76 — OTIIIB (IOT&E) COMPLETE
- JAN 77 — LIMITED PRODUCTION APPROVED

The A–7E FLIR program started in 1972. It was progressed successfully through all test and evaluation milestones. Six preproduction prototypes were ordered in September 1976 and limited production was commenced in January 1977 subsequent to Navy department review. The system met or exceeded all performance, reliability and maintainability requirements during the OTIIIB (IOT&E) OPEVAL in October 1976.

The A–7E FLIR system is being procured on the basis of one pod for each two aircraft. The chart shows the inventory and deployment plan which introduces the system to the fleet [deleted] the constant inventory during current year 1979. 80 recognizes the lack of funds in fiscal year 1978 caused by recent program decisions. Full production will commence following operational evaluation in early fiscal year 1979.

The two-seat, TA–7C, conversion program is now well underway. This program converts the aircraft by making it 34 inches longer, adding a two-seat cockpit.

Digitized by Google

a side opening canopy and a new wing fairing section. The aircraft will have the full A–7E weapons system as well as specialized weapons system training aids.

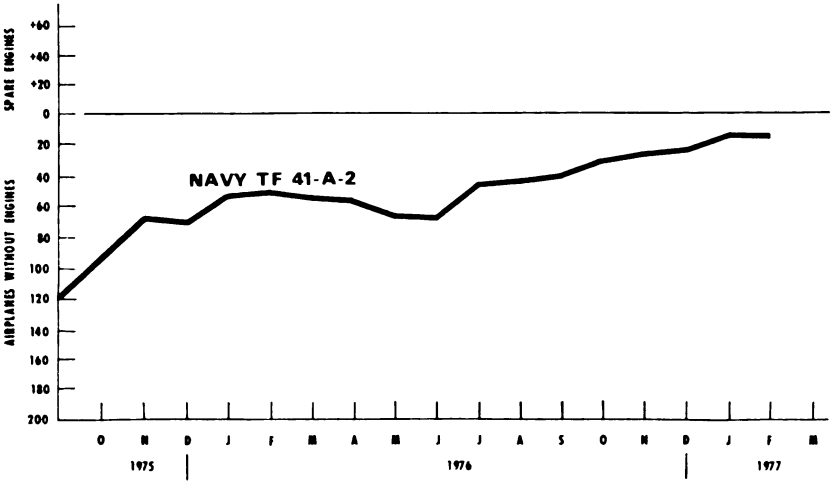
We have inducted 24 A–7B's and 11 A–7C's. The first flight of a converted airplane was made in December 1976 and the operational evaluation will be completed by August 1977. Deliveries to the fleet will commence in the summer of 1977. The program was reduced in fiscal year 1977 from 81 to 65 aircraft as a result of reprogramming actions and in recognition of the need for some A–7E's to remain in the fleet readiness squadrons. We are requesting 33.2 million dollars for the conversion of 14 aircraft in fiscal year 1978.

The A–7 material readinss has been between 55 to 60 percent this past year.

The TF41 engine has been our greatest readiness detractor again this year. As reported last year, the main problem in the TF41 results from higher than anticipated temperatures in the turbine section, installation of unsuccessful fixes, and the expiration of life on certain turbine parts. In August 1975, at a design review, it was revealed to senior management that combustion chamber outlet patterns were approximately 300° higher than previously known and higher than design criteria for the engine. Prior to that time the Government and Allison were engaged in component improvements to increase durability of the first stage inlet guide vanes and to improve the cost benefit of the first stage turbine blades. Both of these fixes or improvements failed to meet expectations, especially in view of the higher than anticipated temperatures. Further, fatigue failures in the first and second stage turbine blades were discovered.

Short term actions were obviously necessary. The temperatures to which the first stage inlet guide vanes were exposed had to be reduced. Accordingly, a manual derate was imposed in which the pilot was limited to 2 minutes of maximum power and lower turbine temperatures for maximum continuous operations. A second action was to purge parts known to be faulty or those in which time limits had already passed. These actions lead to our lowest readiness condition in September 1975. Since then we have been reverting to the original first stage vanes and the original forged first stage blades, which had previously demonstrated better durability in our engines. We imposed life limit on certain engine parts and because of parts shortage experienced approximately 120 aircraft without engines in September 1975. Actual bare firewalls decreased rapidly to 55 and maintained level at approximately 55 until additional supplies of parts available in September 1976.

A-7 ENGINE READINESS



Digitized by Google

Following a joint Air Force/Navy/contractor review in September 1975, a revitalized component improvement program was generated toward a long term solution to the TF41 engine problems.

The results of key program elements are as follows:

A. Combustor modifications were developed which reduce peak temperatures but combustor durability was adversely affected. Efforts in this area are continuing.

B. Engine test cell trim procedures were revised to reduce overtemperature variance approximately 50°F.

C. An engine disassembly and analytical program was instituted to determine hot section component deterioration rates. As a result, the engine was placed on an inspect and repair as needed instead of firm repair interval at 225 hours. This should increase average repair intervals to 375 hours.

D. Testing found higher fuel flow rates to the number eight combustor fuel nozzle and associated higher peak temperature in this combustor. A modification of the fuel manifold has been developed for fleet introduction in April 1977.

E. A new "bullnose" first stage turbine inlet guide vane has been developed. This vane has a greater thickness to chord ratio and better heat absorption and dissipation properties. It will also be available for fleet use in April 1977.

Tests show the bullnose vanes and the fuel manifold modification will allow us to return to unrestricted engine operation. These qualified "fixes" as well as several others have undergone more abusive laboratory testing than ever before through simulated mission endurance testing specifically designed to consider actual fleet use. The new components have over 600 hours of this testing in the laboratory and are being flown in an accelerated service test engine. In April 1977, a 30-engine set will be introduced to the fleet and we plan to accumulate 225 hours on these engines before we commit the entire fleet. This systematic approach is being followed now on an annual basis.

A-7E FY 78 BUDGET SUMMARY

$21.0M FOR CONTINUING SUPPORT

$52.2M FOR MODIFICATIONS INCLUDING TWO-SEAT CONVERSIONS

In summary, we are requesting 21.0 million dollars of fiscal year 1978 funds APN-1 for A-7E support and we are requesting 52.2 million dollars of fiscal year 1978 APN-5 funds for A-7 modifications including the two-seat, TA-7C, conversions.

Senator TOWER. Thank you, Captain.

For many years now the backbone of the Navy's light attack aircraft force has been the A-7. The A-7 has proven itself in combat and, over the years, it has undergone evolutionary changes to the point where I believe it is fair to say the A-7E is the best light attack aircraft in the world today.

Recently, Navy has been moving toward a 24-squadron force of A-7E's, and this program was on track until the fiscal year 1978 budg-

Digitized by Google

et process this past year. At that time, by a series of actions, the logic of which I fail to understand, the A–7E program was terminated.

Not only does this mean there will be a shortfall in Navy's A–7E force; but, perhaps more importantly, it means the only light attack aircraft production line in the United States, and in the free world as far as I know, will be shut down.

Mr. Chairman, it is no secret that I have a parochial interest and concern in this particular matter, but my concern is larger. The revised defense budget not only terminated this program, it terminated nonnuclear Lance, cut the B–1 from 8 to 5, cut back on MX development, reduced the FFG's from 11 to 9, cut the advanced attack helicopter program by $100 million, reduced the number of Hawk batteries, cut the F–15 production from 9 to 6½ per month, cut AWACS from 6 to 3, and slipped the Army's MICV program a year. There were other reductions and, as we know, the total cut was $2.8 billion.

In our hearing just last week, it was pointed out that in about 1983, at the very time the A–7E shortfall will be most apparent, the Soviet Union and Warsaw Pact will have us and our NATO allies outnumbered 3 to 1 in tanks, 5 to 1 in artillery tubes, 2½ to 1 in armored personnel carriers, 3 to 1 in combat helicopters, 3 to 1 in counterair, 2 to 1 in RECCE and 14 to 1 in medium bombers.

These figures, I might add, assume we were getting many of the programs that were terminated or slowed down.

So, I fail to see why it makes sense to terminate the A–7E production line and deliberately put ourselves in a worse shortfall position than is already contemplated. In fact, it makes no sense at all; and such an action, under the guise of defense economy, is not in our national security interest. I say this because it is an action that insures our Navy will not be provided with the force levels it requires when the Soviet threat is projected to be most severe.

Now, Admiral Turner, I have a number of questions on the A–7E program that I would like either you or your staff to answer.

First, in 1975 what did the 5-year defense plan show as the requirement for the A–7E aircraft?

Admiral TURNER. 150, sir.

Senator TOWER. 150. That is for fiscal year 1976 through 1980, right?

Admiral TURNER. Yes, sir.

Senator TOWER. Was the projection the same in 1978?

Admiral TURNER. Yes, sir.

Senator TOWER. Until the 5-year defense plan was changed, how many A–7E's did Navy want to procure?

Admiral TURNER. 120, sir.

FORCE STRUCTURE BASIS FOR A–7E

Senator TOWER. What is the validity of the requirement for 24 light attack squadrons and how is it tied to Navy carrier force structure?

Admiral TURNER. Navy carrier force structure is authorized at 12 deployable large deck aircraft carriers, plus 1 for contingency purposes as well as the air wings that go with the 12 deployable squad-

Digitized by Google

rons. Each of the air wings on these carriers has two light attack squadrons. Therefore, the 12 authorized carriers and the 2 light attack squadrons per carrier equal the number of 24 for the desired and required light attack squadrons in the active forces.

FISCAL YEAR 1978 BUDGET PREPARATION

Senator TOWER. During the fiscal year 1978 budget preparation process that took place last year, what was Navy's initial request to OSD for A-7E's?

Admiral TURNER. Thirty aircraft, sir, for 1978.

Senator TOWER. What was that request based on?

Admiral TURNER. That was based on the requirement to continue the progress toward an all A-7E light attack force on a yearly basis looking forward 4 more years of procurement at 30 aircraft per year.

Senator TOWER. What was the guidance received from OSD and what date was that received?

Admiral TURNER. I will have to, if I may, provide that for the record. I don't have that with me.

Senator TOWER. All right, Admiral, if you would supply that for the record.

Admiral TURNER. Yes, I will.

[The information follows:]

The guidance received was essentially that of using existing A-7A/B assets to maintain force levels until introduction of the A-18 into the light attack inventory. This guidance was received in late November 1976.

Senator TOWER. Did Navy reclama that guidance or was that not allowed?

Admiral TURNER. During the programing, planning, and budgeting cycle the Navy did reclama the guidance provided by OSD.

Senator TOWER. So in May 1976 or subsequently Navy was planning on requesting 27 A-7's in the fiscal year 1978 budget plus the same number in fiscal year 1979?

Admiral TURNER. That is correct, sir.

Senator TOWER. What did that new figure do to your outyear planning? Would there have been any shortfall at that level?

Admiral TURNER. The Navy's submittal was for 27 per year over a 4-year period. That would not have produced a shortfall but in the programing decision memorandum received by us from the Secretary of Defense, the numbers were reduced to 27 in 1978, 27 in 1979, and 18 in 1980, none in 1981. That procurement schedule would have produced a shortfall of 36 A-7E's.

Senator TOWER. What was Navy's response to this?

Admiral TURNER. We reclamaed that particular guidance, sir.

Senator TOWER. Now, would you provide that reclama for the record?

Admiral TURNER. Yes, I will.

[The information follows:]

A reclama was submitted. The reclama stated that the requirement for A-7E procurement subsequent to fiscal year 1977 is to provide A-7E force level assurance for 24 active squadrons until introduction of the A-18. The reclama highlighted Navy light attack shortfalls and stated that termination of the A-7 production line will reduce the capability to respond to a contingency should

Digitized by Google

the need arise for additional light attack forces or should the A–18 introduction phasing be delayed. Premature termination of the A–7E procurement creates an A–7E inventory shortfall in the early eighties that prevents the Navy from maintaining an all A–7E active force. While this shortfall can be temporarily circumvented by utilizing the A–7B, this older aircraft is far less capable, maintainable, and reliable. Of the alternatives that have been proposed, none are as cost effective as continued A–7E procurement. The reclama, in summary, supported the importance of sustaining the procurement of six aircraft which, while falling short of Navy requirements, would provide replacement equal to half a squadron and bridges the gap between the fiscal year 1977 procurement and a potential FMS program.

Senator TOWER. In which office in OSD was this going on and who was the primary person responsible to make these recommendations to the Secretary?

Admiral TURNER. I don't know that of my own knowledge, Senator Tower. It is a process that goes on to my knowledge through many offices but specifically which one made the decision, I don't know.

Senator TOWER. Has any reason been given for the planning guidance received thus far?

Admiral TURNER. The general reason given concerned three things. One, the reduction of the A–7E procurement based on increased procurement of F–14's to be used in a reconnaissance role. Second, the planned introduction of the A–18 to coincide with a changeover, a routine changeover period designed to minimize any shortfall and the third point being that they, Navy, do have other A–7 aircraft, namely A–7A, A–7B's, and A–7C's. The statement was made that all of those models taken together do fulfill the Navy's numerical needs for light attack aircraft.

Senator TOWER. Admiral, there may be some repetition here but I am trying to establish these questions so if you will bear with me. What was the next date of efforts that occurred in the A–7 budget, A–7E budget process?

Admiral TURNER. Following the Navy's reclama the matter was taken up in the major budget issues and the number of A–7's to be procured then goes through a series of changes over the various dates. If I may, up to December 1978, we had a budget decision which eliminated the A–7E's entirely. That was reclamaed and on December 16 we had a subsequent program, budget decision which placed 24 A–7E's in 1978 and none in 1979, 1980, or 1981. Another in interation on December 23, again from the office of the Secretary of Defense, changed the number to six in 1978 and none in 1979, 1980, or 1981 and that is the figure which now remains. Correction, did remain until January 29, 1977, when the program was reduced to zero across the board.

NAVY RATIONALE FOR A–7E PROCUREMENT

Senator TOWER. What rationale was provided to the new administration in defense of the A–7E?

Admiral TURNER. The rationale provided was that it was the Navy's plan and desire to have an all A–7E light attack force. We recognized that we did have numerically adequate numbers of older A–7A's, B's, and C's, but have stated unequivocally that the capabilities of these older aircraft are so much less or so inferior to the A–7E's that it was

Digitized by Google

a desired aim and intention of the Navy to have the better equipment. the more capable aircraft if possible.

Senator TOWER. Have you had an adequate opportunity to present your case to this administration?

Admiral TURNER. As I indicated from the various iterations it was addressed and readdressed to the Ford administration a number of times. In President Carter's new administration the matter was surfaced again and I know the Chief of Naval Operations did have opportunity to discuss this matter with the new Secretary of Defense.

Senator TOWER. If the Navy had not opted for the A–18 program. what would the requirement be for the A–7E in annual production and for how long?

Admiral TURNER. I will have to supply that for the record.

[The information follows:]

The A–7E force would require approximately 14 A–7E's per year until such time as a replacement was delivered.

PROCUREMENT TOTAL

Senator TOWER. Thank you. Admiral. How many A–7E's are now on order and how many will have been bought if the program is terminated this year?

Admiral TURNER. 572 will have been purchased if the program is terminated this year. Funded and undelivered as of January 1. 1977. we had 66 aircraft. Since that time. of course. more have been delivered. I believe I have the figures here. Yes. 60 still to be delivered.

Senator TOWER. What is the current production rate and what year were those aircraft approved?

Admiral TURNER. The current production rate is an average of 2½ aircraft per month. These are the fiscal years 1976/7T/77 aircraft.

Senator TOWER. Will you provide for the record a chart that shows the production details and when the line would close down assuming there are no further A–7E's?

Admiral TURNER. I will be happy to.

[The information follows:]

The delivery schedule is as follows:

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1977												
Fiscal year 1976 (30)	1	1	3	3	3	3	3	3	3	3	2	2
Fiscal year 19TQ (6)												
Fiscal year 1977 (30)												
1978												
Fiscal year 1976												
Fiscal year 19TQ (6)	2	2	2									
Fiscal year 1977 (22)				2	3	2	3	3	2	3	2	2
1979												
Fiscal year 1976												
Fiscal year 19TQ												
Fiscal year 1977 (8)	2	3	3				Line shutdown					

Digitized by Google

FISCAL YEAR 1978 BUDGET ITEMS

Senator TOWER. The termination chart gives approximately $21 million. How is that figure determined? Is that a correct figure to begin with?

Captain DUNNING. The $21 million is for continued procurement of A-7E support. mostly in the ground support equipment area, for two squadrons of A-7E's. Termination charges are very difficult to come by but we are anticipating them to be on the order of about $8 million.

Senator TOWER. What is the current fiscal year 1977 flyaway cost for the A-7E?

Admiral TURNER. $4.977 million.

FILLING A-7E SHORTFALL

Senator TOWER. We discussed the 36 A-7E shortfall and why those aircraft are required. What is the most economical way for the Navy to buy and to produce those aircraft?

Armiral TURNER. We would be best advised I think to provide that for the record in detail, Senator, if I may, but my intuitive feeling is for 36 aircraft probably 2 years would be an optimum program. But how many in each year I would like to research if I may.

Senator TOWER. Would you include in that what combination per year would be best for a 2-year program?

Admiral TURNER. Yes sir.

Senator TOWER. Provide for the record your estimate of the funds required for any options.

Admiral TURNER. Yes, sir.

Senator TOWER. Incidentally, Admiral, if you would be expeditious with this we will appreciate it because we need responses as soon as you can get it to us.

Admiral TURNER. Very rapidly.

Senator TOWER. Would you include long lead requirements?

Admiral TURNER. Yes sir.

[The information follows:]

The most economical way to procure the 36 aircraft would be to procure them all in one year.

The best combination for the 2-year procurement would be: fiscal year 1978, 24; fiscal year 1979, 12.

For the best combination the funding would be: fiscal year 1978, 24, $170.1 million; fiscal year 1979, 12, $87.1 million.

Senator TOWER. Are there any funds in the Navy's APN you would be willing to divert to A-7E program if authorized?

Admiral TURNER. It is a very difficult question. I find myself dealing from shortages in many of these contracts. I would like to be able to offer up something but I really can't.

Senator TOWER. Would you please review the record and where required make sure there is an adequate and clear track of the fiscal year 1978 budget decision process and use tables if required?

Admiral TURNER. Yes sir.

Senator TOWER. We established the shortfall in the light attack force will be 36 or more if the A-18 makes its scheduled IOC in fiscal

85-370 O - 77 - 31

Digitized by Google

year 1983. How does the shortfall increase for each month the IOC on the A–18 slips?

Captain DUNNING. Approximately one aircraft per month on the attrition basis we have today.

[The information follows:]

Two aircraft per month for the first two years following planned IOC of the A–18, thereafter, four per month.

Admiral TURNER. The planned IOC for the A–18 is in fiscal year 1984, not 1983.

Senator TOWER. Could you give us the IOC date on that?

Admiral TURNER. Yes sir. I have the year. I will have to get it closer.

Senator TOWER. You used the term fiscal year 1983. It might be calendar year 1984 instead of fiscal year 1983.

Captain LENOX. We will have 12 A–18's delivered by September 1983.

Senator TOWER. Has there been any slippage in F–18 to date?

Admiral TURNER. The first F–18 flight was delayed 2 months to avoid a funding and scheduling incompatability but this will not impact the A–18. It is difficult, in fact impossible to find a program that is really on its initially planned schedule. We have a slight difficulty and there will be a 2-month delay on the F–18 but none on the A–18.

A–18 PROGRAM SCHEDULE

Senator TOWER. Can the A–18 program be accelerated and what would be required to accelerate the program to the point where there would be no shortfall in the light attack force?

Admiral TURNER. That is a very involved question, Senator Tower and, if I may, I think I will have to provide the answer for the record, because it involves looking at production schedules, cost and the like. We will provide it as quickly as we can.

[The information follows:]

The A–7E shortfall occurs prior to the planned IOC of the A–18. Therefore, the A–18 would have to be accelerated by a minimum of two years to be effective. To undertake a two-year program acceleration: would require the Navy to assume unnecessary technical risks; would generate numerous inefficiencies; would require an immediate unbudgeted funding increase to develop and test the ancillary equipment that is unique to the A–18; and, would seriously degrade the service's plan to introduce the A–18 in the fleet in an orderly cost-effective manner. Accelerating A–18 procurement by two years to eliminate the A–7E shortfall is a technically and economically undesirable solution to the Navy's light attack force level problems in the early 1980's.

The current procurement program for the A–18 is the following:

Procurement	Delivery	Quantity
Fiscal year 1981	[Deleted]	12
Fiscal year 1982	[Deleted]	36
[Deleted.]		

This represents an acceleration from the previous program of nine (9) total F/A–18 Aircraft per month to eleven (11) aircraft per month as shown in the Congressional data sheet. The program for the years shown above could be further accelerated through procurement of additional A–18 Aircraft in fiscal year 1981 and subsequent years.

Digitized by Google

A major restructuring of the flight test program would be necessary in order to procure attack aircraft prior to fiscal year 1981.

Senator TOWER. Admiral, when is the F–18's first flight scheduled and when is the first A–18 flight scheduled?

Admiral TURNER. The first F–18A is scheduled to fly in September 1978 and the A–18 is a little more imprecise. That will occur in the third quarter of 1980.

Senator TOWER. Are you confident the A–18 program will make its IOC as scheduled?

Admiral TURNER. For the dates I have just given, yes, sir.

RISKS IN SHORTAGE OF A–7E'S

Senator TOWER. What are the risks in knowingly creating shortfall in our light attack force in 1982–83 time frame?

Admiral TURNER. I think I have to address that in two ways. One, in terms of total A–7 aircraft of all models, there will be no light attack shortfall in those time frames. Strictly in terms of the A–7E, yes, there will be a shortfall in those time frames of some 36 aircraft. That equates to approximately three squadrons. The risks are a matter of conjecture and personally, as a former fleet commander, I would prefer the more advanced weapon system. There would be less risk with those kinds of more modern aircraft. However, if I had to operate A–7B's or C's I could still find a useful role for them but the risk factor would be increased by some measure based on whatever the scenario is during that time frame. I noted in my remarks earlier talking about 6th Fleet operations that I was using the earlier models at that time to a degree of effectiveness which I thought was quite satisfactory at that time. Now looking at 1982 or 1983, with the continual advancement of technology, I think we should, again personally speaking—keep pace with the technology and have the best systems available.

A–7E PRODUCTION STARTUP TIME

Senator TOWER. If the A–7 production line is shut down what would be the minimum time required to restart the line and provide the first production aircraft for the fleet?

Admiral TURNER. Again, I think I am going to have to go to the systems command and the manufacturer to provide the details for you, sir, and with your indulgence we will provide them rapidly for the record.

Senator TOWER. Thank you, Admiral. I will leave all these questions to be answered for the record so that they will be readily available in one place.

QUESTIONS SUBMITTED BY SENATOR TOWER

(Questions by Senator Tower to be answered by the Department of the Navy follow:)

Senator TOWER. Admiral Turner, if the A–7 production line is shut down, what would be the minimum time required to restart the line and provide the first production aircraft to the fleet?

Digitized by Google

Vice Admiral TURNER. If the A–7 production line shutdown was anticipated and was reasonably short, in the order of 6 months, it would require approximately 24 months from go-ahead to delivery of the first airplane to the fleet.

Senator TOWER. In 1975, what did the Five Year Defense Plan show as the requirement for A–7E aircraft?

Vice Admiral TURNER. A total of 156 as set forth below:

Fiscal year:

1976	30
197T	6
1977	30
1978	30
1979	30
1980	30

Senator TOWER. Was the projection the same in 1976?

Vice Admiral TURNER. Essentially, yes.

Fiscal year:

1977	30
1978	30
1979	30
1980	30
1981	30
Total	150

Senator TOWER. Until the FYDP was changed, how many A–7Es did Navy want to procure?

Vice Admiral TURNER. A total of 72.

Fiscal year:

1978	27
1979	27
1980	18

Senator TOWER. What is the validity of the requirement for 24 light attack squadrons? How is this tied to Navy's carrier force structure?

Vice Admiral TURNER. The current authorized force structure is 12 deployable carriers and 12 active airwings that contain 24 A–7 squadrons.

Senator TOWER. Now, during the fiscal year 1978 budget preparation process that took place last year, what was Navy's initial request to OSD for A–7E's?

Vice Admiral TURNER. The initial request was for 427 aircraft.

Senator TOWER. What was that request based on?

Vice Admiral TURNER. The request was based on the requirement for force level assurance assets to maintain an all A–7E active force.

Senator TOWER. Did Navy reclama that guidance or was that not allowed?

Vice Admiral TURNER. The Navy did reclama.

Senator TOWER. So in May 1976, or subsequently Navy was planning or requesting 27 A–7E's in the fiscal year 1978 budget plus the same number in fiscal year 1979?

Vice Admiral TURNER. That is correct.

Senator TOWER. What did that new figure do to your out-year planning? Would there have been any shortfall at this level?

Vice Admiral TURNER. The quantities of 27/27/18 provided sufficient aircraft to assure A–7E force levels in the 1980s when interfaced with the A–18 introduction.

Senator TOWER. What was the next action in the budget preparation process?

Vice Admiral TURNER. The next action in the budget cycle was the Program Budget Decision phase in which the request for fiscal year 1978 was zeroed out. At this time it was pointed out that a shortfall of 36 A–7Es would occur in the 1982–84 time frame.

Senator TOWER. What was Navy's response to this?

Vice Admiral TURNER. The decision was reclamaed and six aircraft were put back into the fiscal year 1978 budget.

Senator TOWER. Which office in OSD was this process going on with? Who was the primary person responsible to make these recommendations to the Secretary of Defense?

Digitized by Google

Vice Admiral TURNER. It is not personally known to me which office or person made these recommendations to the Secretary of Defense.

Senator TOWER. Had any reason been given for the planning guidance received thus far?

Vice Admiral TURNER. As stated earlier, the Navy would use its entire A–7A/B/E force to assure 24 A–7 squadrons.

Senator TOWER. What was the next significant date and event that occurred in the A–7E budget process?

Vice Admiral TURNER. Major Budget Issues were presented in this process, during mid-December; at this time the six aircraft were reinstated.

Senator TOWER. What were the budget figures then for this program, and what was the date?

Vice Admiral TURNER. The six aircraft were added and 58.0 million dollars was provided. The approximate date of this action was late December 1976.

Senator TOWER. I am advised that in early December 1976, the SECDEF in response to a memo from SECNAV then terminated the A–7E. If that is correct, what caused the SECDEF to make that decision?

Vice Admiral TURNER. As I recall, the SECDEF based his assessment on the antiship capability of the A–6E in the near term, and the expected introduction of the A–18 as a replacement for the A–7E in the mid 80's.

Senator TOWER. Did the earlier SECNAV memo support the need for the A–7E?

Vice Admiral TURNER. Yes sir.

Senator TOWER. Explain how the final figure of six A–7Es finally appeared in the DOD budget, to include all the iterations that took place.

Vice Admiral TURNER. The figure of six A–7Es resulted from a Navy reclama in the major budget issues phase. The various iterations are set forth below:

	Fiscal year 1978
Fiscal year 1977 congressional Jan. 15, 1976	30
Navy submit May 4, 1976	27
SECDEF decision Aug. 25, 1976	27
SECDEF decision Dec. 4, 1976	0
SECDEF decision Dec. 16, 1976	24
SECDEF decision Dec. 23, 1976	0
SECDEF decision Jan. 5, 1977	6

Senator TOWER. During this process, did Navy continue to emphasize the requirement for the light attack force and the shortfall that would occur?

Vice Admiral TURNER. Yes sir.

Senator TOWER. What response was received? Apparently, it was not given much weight looking at the end result.

Vice Admiral TURNER. I have no comment on that sir.

Senator TOWER. What rationale was provided to the new Administration in defense of the A–7E?

Vice Admiral TURNER. Basically, the same information as was previously submitted.

Senator TOWER. Do you feel you had your day in court on the A–7E with the new Administration?

Vice Admiral TURNER. Yes sir.

Senator TOWER. How many A–7Es are now on order, and how many will have been bought if the program is terminated this year?

Vice Admiral TURNER. We have 64 aircraft on order not yet delivered. Through the fiscal year 1977 procurement 572 A–7Es will have been procured.

Senator TOWER. What is the current production rate and in what year were those aircraft approved?

Vice Admiral TURNER. The current production rate is an average of 2½ aircraft per month. These are the fiscal year 1976/7T/77 aircraft.

Senator TOWER. The termination charges are approximately $21 million. How is that figure determined?

Vice Admiral TURNER. The 21 million dollars in fiscal year 1978 are not terminations charges but support costs. The bulk of the funds are for Peculiar Ground Support Equipment (PGSE), publications and training parts. Termination charges are not definitized at this time but are being negotiated between the Navy the contractor.

Senator TOWER. What is the current fiscal year 1977 fly-away cost for an A–7E?

Digitized by Google

Vice Admiral TURNER. 4.977 million dollars.

Senator TOWER. Are there any funds in Navy's APN account you would be willing to divert to the A–7E program, if authorized?

Vice Admiral TURNER. No sir, the budget as submitted is very constrained. There are no funds in fiscal year 1978 that could be diverted at this time.

Senator TOWER. Has there been any slip in the F–18 program to date?

Vice Admiral TURNER. First flight of the F–18 was delayed by two months to avoid funding/schedule incompatibility, but this will not impact on the A–18.

Senator TOWER. Admiral, when is the F–18's first flight scheduled, and when is the first A–18's flight scheduled?

Vice Admiral TURNER. The F–18's first flight is scheduled for Sept. 1978, the A–18 in the third quarter of 1980.

Senator TOWER. Admiral Turner, are you confident the A–18 program will make its IOC as scheduled?

Vice Admiral TURNER. Yes sir.

Senator TOWER. Admiral Turner, what are the risks in knowingly creating a shortfall in our light attack force in the 1982–83 time frame?

Vice Admiral TURNER. The termination of A–7E procurement does not in itself create a light attack shortfall in the 1982–83 time frame, if all A–7 assets are considered. As you know our goal is, and has been, the all A–7E active force which we will achieve this year. The terminatin of A–7E procurement creates an A–7E shortfall in the 1982–84 time frame and prevents the Navy from maintaining an all A–7E active force. While this shortfall, which amounts to 36 aircraft, can be accommodated by employing the older A–7Bs in the active force, it is at the expense of a considerable loss in capability. The risk in my judgment, lies in attempting to meet the projected threat of the eighties with some aircraft of substantially less capability than that afforded by the A–7E.

Senator TOWER. Can the A–18 program be accelerated? What would be required to accelerate the program to the point there would be no shortfall in the light attack force?

Vice Admiral TURNER. The A–7E shortfall occurs prior to the planned IOC of the A–18. Therefore, the A–18 would have to be accelerated by a minimum of two years to be effective. To undertake a two-year program acceleration: would require the Navy to assume unnecessary technical risks; would generate numerous inefficiencies; would require an immediate unbudgeted funding increase to develop and test the ancillary equipment that is unique to the A–18; and, would seriously degrade the service's plan to introduce the A–18 in the fleet in an orderly cost-effective manner. Accelerating A–18 procurement by two years to eliminate the A–7E shortfall is a technically and economically undersirable solution to the Navy's light attack force level problems in the early 1980's.

F–14B ENGINE

Senator THURMOND. I have a few questions on the F–14B engine and a few on the F–18, whichever you gentlemen would prefer to answer. What is the basis for the delay in competition between engine manufacturers for advance F–14 engine?

Admiral TURNER. If I may answer that. We are in the process now of doing the preliminary staffing leading to compliance with the Congress' will to conduct a competitive hardware demonstration of advanced technology engine for the F–14. We will have difficulty in completing it in this fiscal year and we will be coming in with a request for extension to include the fiscal year 1978 as an authorized time to expend the $15 million advanced by the Congress. We desire to look to the future and develop an advanced technology engine. We will be coming in with a program to do that but we have a difficult problem in affordability in trying to determine where the funds might come from to finance such a very extensive venture.

Senator THURMOND. How much additional funding would be needed this year if the F–14B engine program is to go forward as Congress directed last year?

Digitized by Google

Admiral TURNER. To establish a program leading to competition among various manufacturers approximately $59 to $80 million would be required in fiscal year 1978.

Senator THURMOND. How does the delay in this advanced engine by the Defense Department impact on its inclusion in the last F–14 production aircraft?

Admiral TURNER. Advanced technology engine would be very difficult to complete in time to introduce into the currently planned procurement program which looks at 44 aircraft this year, 60 next, 60 the year after and then 42 for delivery in approximately 1981. We would look for the development of advanced technology engine in either 1982 or 1984, preferably the latter, to coincide with a modification and conversion program that we have in mind for the F–14 at that time, to then put new engines in those converted aircraft and commence a retrofit at that time.

Senator THURMOND. What is meant in your statement when you refer to a re-engine program for the F–14 in view of funding required in other high priority projections?

Admiral TURNER. Yes sir, that is the affordability consideration. We estimate that conservatively between $400 and $500 million will be needed to fund a competitive advanced technology engine program. Procurement, based on which manufacturer might win will be on the order of $1.9 to $2.3 billion to produce enough engines for the F–14 that number of engines being 924. The magnitude of that program causes us to evaluate it very thoroughly. We find it difficult to locate and identify the funds which would finance that very extensive and costly program.

F–18 CONFIGURATION CHANGES

Senator THURMOND. Now, turning to a few questions on the F–18, what are the most significant items planned for on the F–18 attack version which have been deleted in an effort to hold cost under control?

Admiral TURNER. If I may, sir, may I introduce as the spokesman for F–18 the Project Manager, Captain Lenox.

Captain LENOX. Senator, very early in this program we considered a wide variety of capability in the A–18 version and decided to not put a noncooperative target recognition feature into the radar. This is a software program that would allow the pilot and the radar to detect an enemy aircraft. That feature was not put in as a cost saving measure before we went on contract with the aircraft. Since then we have deleted——

Senator THURMOND. Would you indicate how important you feel each of these items are?

Captain LENOX. Yes sir. That particular item is relatively important in a combat scenario where you need a positive identification. The rules of engagement would require that you be permitted to use the [deleted] rather than [deleted] in order to use that capability. This capability is not here and proven as a state of the art system and we have in our A–18 design the capability to install it through software modifications at a later date when that technology is available.

Digitized by Google

Senator THURMOND. So you can install this later?

Captain LENOX. Yes sir.

Senator THURMOND. As soon as the state of the art has developed and also you have the funds?

Captain LENOX. Yes sir. Since we have been on contract with the aircraft we deleted a terrain following mode in the radar. We do still have a terrain avoidance mode. The terrain avoidance mode would allow us to see obstructions in the flight path on the radar and avoid them where as the terrain following mode would come in to the autopilot and automatically fly the airplane over or around those obstacles. We do believe the terrain following mode has a level of sophistication and technology risk which we felt we could do without in this single place aircraft.

F-18 CONFIGURATION COMMONALITY

Senator THURMOND. You stated in the current fighter and attack configuration of F-18's the two aircraft are 99-percent hardware common?

Captain LENOX. Yes sir.

Senator THURMOND. What was the original plan for the F-18 attack version and how was the plan changed?

Captain LENOX. The original plan for the attack version was to attempt to optimize some of the software in the radar and mission computer and some of the hardware in the stores management system and the radar through designing those systems to have specific air-to-air or air-to-ground modes provided on individual circuit boards in the hardware. It was felt that we could save money if we designed a black box in which we could remove, or not buy initially, two or three of those circuit boards for the box destined for fighter aircraft and likewise not buy one or more of those circuit boards for a black box destined for an attack aircraft. That was particularly true in the radar.

When the radar selection was announced by McDonnell-Douglas as going to the Hughes Aircraft Co. it gave us an opportunity, through the basic design used by Hughes in the radar, to have a common software program. This is due to a feature that is provided in their basic memory in the radar. It requires no additional hardware. Once we had a common software program in the radar it behooved us to look at the common hardware in the stores management system and the mission computer. We did that and determined that we would achieve an overall life cycle cost advantage if we had a single software suite in the aircraft, thereby requiring only one software support system and likewise we would achieve the benefits of production rate and commonality in support for the hardware. So we were able to derive a system wherein we now have 100-percent software commonality between a fighter and attack version and a near total hardware commonality. I might add that in the weapons system the hardware is entirely common. That 1 percent difference is in the cockpit where the attack aircraft has a color moving map display and the fighter aircraft does not.

Senator THURMOND. What is the attack version cost constraint and how much would be added if the planned modification for the F-18 planned attack version were carried through?

Digitized by Google

Captain LENOX. The difference in the flyaway cost of the attack version and the fighter version is principally the cost of the moving map display. The additional procurement cost differences are reflected in the different numbers of missile launchers and pylon racks and stores that are bought for those two aircraft.

Senator THURMOND. What capabilities in carrying out the attack mission will the Navy be giving up by keeping the F–18 almost exclusively for fighter missions.

Captain LENOX. In my judgment we are not giving up any attack capability in the aircraft. We have a very fine capability and we have added to that an additional combat survivability built into the design so we feel the A–18 will be indeed a very fine light attack aircraft.

COMPARISFN OF F–18 AND PRESENT PLANES

Senator THURMOND. Would you compare the capabilities of the F–18A with the current Navy attack aircraft?

Captain LENOX. Yes, sir. The current attack aircraft has a forward looking infrared pod. We will have that on the A–18. It has a very fine heads up display. We also will have a fine heads up display on the A–18. It has a very fine stores management system and automatic release of bombs. We have that on the A–18. The difference here is that the A–18 version using digital electronics is more flexible and versatile than the A–7E. Additionally, we have a doppler beam sharpening mode for air to ground presentation so we will have a better ground map capability and a better ground map presentation. Likewise, we will have an improved capability in the fact that we have a ground moving target indication and track capability in the A–18.

Senator THURMOND. Captain Lenox, if subsystem performance has been traded off to reduce cost, how would mission performance of the total weapons systems be affected?

Captain LENOX. The mission performance of the total weapons system, sir?

Senator THURMOND. If the subsystem performance has been traded off to reduce cost, how will the mission performance of the total weapons system be affected?

Captain LENOX. The mission performance of the total weapons system will not be affected in that we have not traded off any hard requirements in the aircraft.

Senator THURMOND. What would be the difference in the cost of A–7 and F–18? Maybe the admiral will want to answer that.

Admiral TURNER. As we indicated earlier in response to a question on the A–7, the fiscal year 1977 flyaway cost is now $4.977 million. The cost of the A–18—Captain Lenox has it but it was based on being less than $6 million in fiscal year 1975 dollars on a flyaway basis. We would have to project for the gross due to escalation from 1975 to the delivery date and compare that number with the $4.977 we have now.

Captain LENOX. We would have to get those comparisons in the same year constant dollars.

Admiral TURNER. The answer is the A–18 would be more expensive.

Senator THURMOND. Approximately how much?

Digitized by Google

Admiral TURNER. I would have to provide that for the record. [The information follows:]

The A–18 unit recurring flyaway cost is currently estimated at $6.04 million in fiscal year 1975 dollars. The comparable A–7E unit recurring flyaway cost in fiscal year 1975 dollars is $3.256 million. However, if Vertical Ejector Rack and rate tooling (which are normally priced in the A–18, but not included in the A–7E cost) are included, the A–7E cost increases by $.17 million.

COMPONENT COMMONALITY OF F-16 AND F-18

Senator THURMOND. Has there been a real attempt to use common components or subsystems on the F–16 and F–18 and if so in what way?

Captain LENOX. During the source selection process for the F–18 and shortly thereafter, as we were refining our avionics suite, the Naval Air Systems Command was involved in a long and detailed dialog with D.D.R. & E. with respect to the complete avionics suite in the aircraft. The aim there was to achieve commonality if at all possible with the F–16 and also to look at commonality with other Navy systems to achieve the obvious support advantage. Due to the unique Navy requirements and the large number of avionics which were already under development, or being used on other Navy aircraft, it was finally determined that the avionics suite in the A–18 and F–18 were pointed toward commonality with existing Navy systems where possible and toward the new systems which had unique Navy carrier suitability requirements, to the extent that we were able to use existing systems used in the F–16. We do have the same gun that the F–16 has. Within the avionics area where we conducted our most intensive investigations, we were not able to achieve any commonality with other systems in the F–16.

COST TRADEOFFS

Senator THURMOND. In attempts to bring contractor cost in line with your goals what changes if any were made to goods and services to be supplied by the contractor in order to get cost in line?

Captain LENOX. We have been involved in a continuous effort through trades to reduce the cost of the aircraft and in my prepared remarks I show a chart which illustrates some of the trades we have made. For example in trading performance, in order to achieve lower costs in the aircraft, we have been diligent within the discipline of design to cost and have tried in every way possible to retain the required capabilities while giving up anything that could be identified as not being an absolute requirement. In that process we have reduced the radar modes that I spoke to earlier. We have modified the airframe in two significant areas. One, in which we installed a larger wheel and tire on the fighter aircraft, which was originally intended to be on the attack aircraft. That was due to the fact that the attack aircraft normally would come back and land with heavier weights and require a larger tire. This larger tire is common with that used on the F–4J and S–3A. We did accept a weight penalty in our fighter and a cost penalty and a drag penalty due to small bump required on the landing gear door in order to install that common wheel and tire on

Digitized by Google

the F–18. We did achieve a significant cost savings in that trade. Additionally we required the contractor to install a tail hook design which was external to the mold lines of the aircraft, whereas his original design was internal. That caused us a little drag on the aircraft due to the fairing for the pivot, but the tradeoff there was in increased reliability through deleting one actuator and a complex articulating mechanism to operate the tail hook.

Senator THURMOND. That is all, Mr. Chairman. Thank you very much.

Senator TOWER (presiding). Thank you, Mr. Cromwell, do you have some question?

A–7E FLIR SYSTEM

Mr. CROMWELL. Is the A–7E FLIR system usable on the Air Force A–7D?

Captain DUNNING. Yes sir, the pod will fit on the airplane. The Air Force would have to procure the new computer we have to go with our FLIR system. The Air Force will have to procure a new computer which goes along with the FLIR system and it is a formfit and function replacement for theirs and ours. And they will have to procure modified heads up display replacement and associated wire to connect the system together. They will also have to procure an appropriate ground support equipment and publications and so forth.

Mr. CROMWELL. Those are no different than what the Navy has to buy also to support the FLIR?

Captain DUNNING. A great deal of the components and the ground support equipment and software in the programs are the same.

Mr. CROMWELL. Will that FLIR pod system be adaptable to the F–16?

Captain DUNNING. I cannot answer that question, sir.

Mr. CROMWELL. Can you think of any conceptual reason why it can't since the F–16 has a heads up display, has a computer, has inertial NAV system?

Captain DUNNING. The FLIR pod should be readily adaptable to the F–16 aircraft. Since the F–16 uses digital avionics equipment similar to the A–7 or A–18, minor changes such as adding a roster recommend display for the cockpit head-up display (HUD) controls, wiring and software inputs are required.

Mr. CROMWELL. What would have to be done to adapt that pod to the A–10?

Captain DUNNING. I cannot answer that question.

Mr. CROMWELL. Would you check with the Air Force and supply the answer for the record?

Captain DUNNING. Yes sir.

[The information follows:]

The FLIR pod is presently not adaptable to A–10 aircraft. The A–10 weapon system does not have a computerized digital display systems and thus would require major avionics additions in order to use the FLIR pod.

Mr. CROMWELL. I have some more questions on the A–7E I will just put in the record.

Digitized by Google

Senator TOWER. I think Admiral, we would like to see the F–18 presentation. Unfortunately I won't be able to stay but Mr. Cromwell is here. You may proceed.

Admiral TURNER. Captain Lenox again is the project manager. He has a statement.

Mr. CROMWELL. Go ahead and give it.

F-18 PROGRAM REVIEW

Captain LENOX. Good morning, Mr. Chairman. I am pleased to present, in this my first appearance before your committee, the F–18 Naval Strike Fighter program. The F–18 multimission fighter will replace the F–4 fighter aircraft in the Navy and Marine Corps and will also, in the A–18 designation, be the light attack aircraft replacement for the A–7 in the Navy carrier air wings. The strong emphasis on reliability and maintainability during the design and development phases will enhance fleet readiness and yield lower ownership costs for this new tactical aircraft. Taking advantage of lessons learned, combat survivability has been a priority design parameter. This emphasis will increase the staying power of our carrier strike forces.

REQUIREMENT

VF MODERNIZATION	*VAL MODERNIZATION*
• 18 USN F-14 SQUADRONS	• 24 USN A-18 SQUADRONS
• 6 USN F-18 SQUADRONS	• 6 USNR A-18 SQUADRONS
• 12 USMC F-18 SQUADRONS	
• 4 USNR F-18 SQUADRONS	
• 2 USMCR F-18 SQUADRONS	

Our requirement goals remain the same as stated last year. The need to replace our aging F–4 fighter forces, especially in the Marine Corps, remains firm with an initial operational capability in September 1983 still imperative. Our continued numerical inferiority in tactical aviation relative to potential threat forces adds impetus to these requirements. The Navy/Marine Corps fighter modernization goal is 42 squadrons, consisting of 24 F–18 squadrons and 18 F–14 squadrons. For the Navy light attack force, the goal is an A–18 force of 30 squadrons [deleted] with initial fleet deliveries in 1983.

The current design of the F–18 was developed through an interative design to cost process during which critical system characteristics were

Digitized by Google

weighed against flyaway cost and total life cycle costs. A true multi-mission capability has been derived through use of state of the art digital electronics. Subsystem design is driven by the most demanding reliability and maintainability requirements ever placed on a tactical aircraft development. These features, along with maximum use of mature technology and a reliable engine, will contribute significantly to the major objective of lower ownership costs.

DESIGN-TO-LIFE-CYCLE-COST

OBJECTIVE:

LOW COST MULTI-MISSION TACTICAL AIRCRAFT

- CONTROL FLYAWAY/PRODUCTION COSTS
- REDUCED OPERATING AND SUPPORT COSTS

In our design to cost program on the F–18 we have emphasized the concept of design to life cycle cost rather than design to a particular flyaway cost number. The objective of our life cycle cost program is shown on this chart. In this process we are emphasizing the control of operating and support costs as well as specific efforts to reduce the flyaway production costs.

COST REDUCTION PERFORMANCE TRADES

- COMMON WHEEL/TIRE INCORPORATED
- CONTROLS AND DISPLAYS COMMONALITY
- REDUCED RADAR MODES
- EXTERNAL ARRESTING HOOK
- REDUCED USE OF COMPOSITE MATERIALS

In keeping with the design to cost discipline, performance has not been emphasized above other design parameters. Specifically, a pri-

Digitized by Google

ority on reliability and lower ownership costs has led to numerous design trades which accept weight increases and/or aerodynamic performance penalties.

BASIC CONFIGURATION COMPARISONS

NAVY FIGHTER	2 UHF RADIOS	HORIZONTAL SITUATION INDICATOR	ALL OTHER COMPONENTS IDENTICAL	
NAVY ATTACK	2 UHF RADIOS	MOVING MAP DISPLAY		
MARINE FIGHTER	1 UHF 1 VHF	HORIZONTAL SITUATION INDICATOR		
TRAINER	2 UHF RADIOS	HORIZONTAL SITUATION INDICATOR	400 LB LESS INTERNAL FUEL	2 SEATS

Last year, the Navy presented five basic configurations of the F–18. The Navy and Marine fighters, the Navy attack, and two, two-seat trainers. During the past year the design to life cycle cost process continued to initiate studies and recommend alternatives. As a result, the basic fighter and attack versions now differ only in minor avionics equipment, and one trainer configuration has been deleted. Contrary to the trends of the past, where basic configurations for fighter and attack aircraft have tended to diverge in pursuit of increased performance, the F–18 program has achieved a high level of commonality among configurations and with existing Navy systems in order to realize savings in production, support, and training. In the current fighter and attack configurations, the basic aircraft are identical in software configuration and over 99 percent hardware common.

PERFORMANCE SUMMARY (U)

CHARACTERISTIC	DCP		DSARC II (DEC 75)	CURRENT EST
	GOAL	THRESHOLD		
COMBAT RADIUS, VF ESCORT (NM)	450	400	420	417
COMBAT RADIUS, VA STRIKE (NM)	650	550	618	614
ACCELERATION: MACH 0.8-1.6 (SEC)	80	110	95	98
CARRIER SUIT/SPEED, $V_{PA\ MIN}$ (KT)	125	132	125	127
AIR-TO-AIR RADAR LOOK-DOWN DETECTION RANGE (NM)	DELETED			

Digitized by Google

A summary of F–18 performance as compared to thresholds and goals from our DCP is shown in this viewgraph. The current estimate is holding at about the same numbers that were estimated a year ago. Minor changes in the aerodynamic lines since source selection (due to an external tail hook and larger wheels and tires on the fighter) have caused a degradation in acceleration. This change is a result of our life cycle cost program in which these configuration changes have been made in the interest of increasing reliability and reducing our logistic support costs. We are holding above threshold in all cases.

PROGRAM FUNDING SUMMARY

(THEN YEAR $, MILLIONS)

	PRIOR YEARS	FY-78	FY-79	TO COMP.	TOTAL
• DEVELOPMENT					
FY-77 BUDGET	499.8	639.6	431.6	263.4	1,834.4
FY-78 BUDGET	493.1	626.6	431.2	418.3	1,974.2
• PROCUREMENT					
FY-77 BUDGET		11.0	634.4	10,323.0	10,968.4
QUANTITY			15	785	800
FY-78 BUDGET		29.3	517.0	10,271.7	10,813.1
QUANTITY			9	791	800
• MILCON					
FY-77 BUDGET				28.3	28.3
FY-78 BUDGET				28.5	28.5
• TOTAL PROGRAM					
FY-77 BUDGET					12,831.1
FY-78 BUDGET					12,815.8

A funding profile overview of the entire program compares current estimates with those briefed during hearings on the fiscal year 1977 budget. The development program shows an increase of approximately $140 million over last year's budget, while the procurement account is reduced by approximately $155 million for an overall program cost reduction of $15.3 million.

The principal changes in development are a small reduction in fiscal year 1978 due to Secretary of Defense and Navy budget decisions and an outyear increase which is the result of final definitization of our development contracts.

The reduction in procurement costs is due to accelerated deliveries as directed in a Secretary of Defense budget decision in September 1976, a more detailed definition of total program support and spares requirements, and life cycle cost trades.

Digitized by Google

UNIT COST SUMMARY

	FY-77 BUDGET		FY-78 BUDGET	
	(75 $ M)	(TY $ M)	(75 $ M)	(TY $ M)
FLYAWAY	6.14	10.33	6.13	10.21
PROCUREMENT	8.19	13.71	8.15	13.52
PROGRAM	9.87	15.82	9.95	15.80

My estimates of the unit costs for the F–18 are portrayed here in fiscal year 1975 dollars and in then year dollars. The flyaway costs are for all configurations combined and include the ancillary equipment for each configuration such as missile launchers, bomb racks, and external fuel tanks. Unit costs this year are slightly less than last year's estimates.

FULL SCALE DEVELOPMENT MILESTONES

MILESTONE	PLAN	ACTUAL
• DSARC II	AUG 75	DEC 75
• CONTRACT AWARD		
AIRFRAME	SEP 75	JAN 76
ENGINE	SEP 75	NOV 75
• RADAR SOURCE SELECTION	SEP 76	AUG 76
• FIRST F-404 ENGINE	FEB 77	JAN 77
• F-404 PRELIMINARY FLIGHT RATING	JUN 78	
• FIRST FLIGHT	SEP 78	
• F-404 QUALIFICATION TEST COMPLETE	JUL 79	
• INITIAL SEA TRIALS	OCT 79	
• DSARC IIIA	MAR 80	

Two significant milestones were met during the past year with the selection of the radar supplier and the testing of the first F–404 engine. Two engines are under test at this time and a third will begin running next month. Engine testing is proceeding on schedule, with specification thrust and fuel consumption already having been achieved.

As a part of contract definitization and in order to avoid an incompatibility between planned funding profiles and work schedules,

Digitized by Google

the first flight of the F–18 has been rescheduled from July 1978 to September 1978. As a result, initial sea trials also have been rescheduled from August to October 1979. This rescheduling is not expected to have an impact on the timely completion of the flight test program.

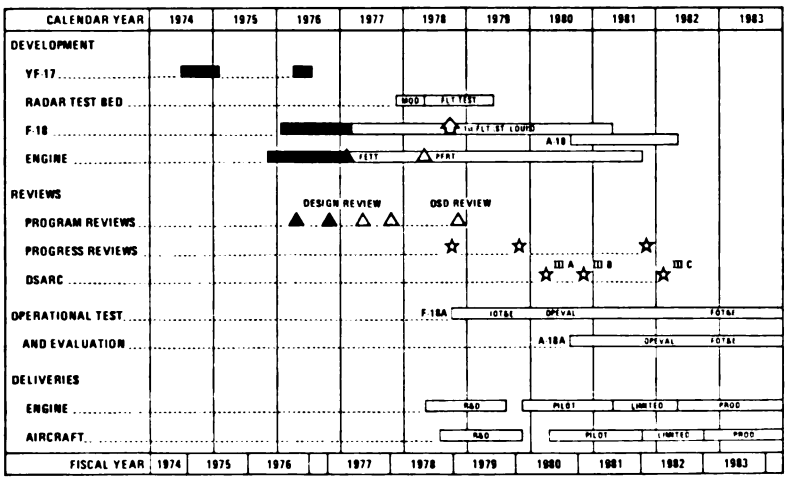
THE F-18 PROVIDES

- **LOW COST NAVY AND MARINE CORPS TACTICAL AIRCRAFT**
- **MULTI-MISSION CAPABILITY**
  - OPERATIONAL FLEXIBILITY
  - REDUCED AIRCRAFT TYPES
  - COMMON SUPPORT
- **SIGNIFICANTLY IMPROVED**
  - RELIABILITY
  - MAINTAINABILITY
  - SURVIVABILITY

Upon entering fleet service, the F–18 will provide an affordable aircraft in terms of both flyaway cost and operating and support costs. The combat versatility of the multimission F–18 will provide the operational commander with a flexibile carrier air wing which can be tailored to requirements of the combat scenario.

Fleet readiness will be enhanced by the F–18. Major improvements in reliability and maintainability will produce more available aircraft to counter opposing forces and a substantial increase in combat survivability will reduce losses to enemy fire.

F-18 SUMMARY SCHEDULE



Digitized by Google

The flight test portion of the F–18 development builds upon the very successful testing of the YF–17 prototype by Northrop and the U.S. Air Force. In addition, NASA conducted flight tests on the YF–17 in the summer of 1976 during which data specifically requested by the Navy were gathered for use in F–18 design refinement. The YF–17 has also been flown by Navy pilots to evaluate flying qualities, performance, service suitability, and air combat maneuvering. A radar test bed has been introduced in the flight test program to minimize development risks in the weapon control system of the F–18, to increase confidence in attaining reliability requirements, and to gain an early assessment of radar design and operation. Development design reviews and progress reviews during flight test will proceed program approval decisions by the Defense Systems Acquisition Review Council at each production milestone. A closely integrated Navy testing program will insure a coordinated and efficient development program in which the Navy's independent operational test and evaluation force maintains a continual participation.

SUMMARY

- DESIGN MEETS OBJECTIVES
- NEW ACQUISITION DISCIPLINES EMPHASIZED
- LOWER OWNERSHIP COSTS ACHIEVABLE
- COST, SCHEDULE, AND PERFORMANCE BALANCED

The F–18 is a sound aircraft design which will provide a reduction of aircraft types abroad Navy carriers and the reduced life cycle costs desired by both the Navy and the Congress.

We have come a long way this year, accomplishing all program milestones in dynamic balancing of life cycle cost, schedule, and performance. We have aggressively implemented programs designed to enhance fleet readiness and reduce total ownership costs. F–18 program management is fully dedicated to the continuing challenge of meeting these objectives.

That completes my presentation. I will be pleased to answer your questions.

TECHNICAL STATUS

Mr. CROMWELL. Captain Lenox, your technical performance data on the airplane you presented today looks very good. Also you said the engine is performing well. Would you give us your overall assess-

Digitized by Google

ment of technical progress on the program? In other words are there any technical areas that are red flagged or yellow flagged at this point in time?

Captain LENOX. At this point in time there are no technical areas that are red flagged. I have yellow flagged two or three areas. One of those is the engine, for two reasons. Engine development has historically been a problem area. Our current experience in engines drives me to be more concerned about the engine. The second reason is that we recently had a minor incident in the engine development program wherein the tips of two of the stage 2 fanblades broke off and caused some minor damage in the engine. I am pleased to say our analysis shows that was a unique problem due to those blades being a little thinner than specification tolerance at the tip. These were the first blades we had used. The engine has been repaired and is back in service running at this time. I might add a note also with respect to that particular incident. The damage was not discovered because of any malfunction or performance degradation in the engine. The engine was running at full power producing specification thrust during an endurance test. The nozzle began to fluctuate and the engine was shut down to determine the cause of that fluctuation. It was finally determined to be a piece of test equipment, a pump, that was causing it. A routine borescope inspection was run on the engine while it was shut down. This inspection revealed damaged blades which caused a more in depth inspection: an opening of the case and examination of the engine.

If the performance of the engine at that plant is an indication, it would appear we have a very FOD resistant engine in the F–404. We have been conducting ongoing analyses, stress analyses, on this fan section to insure that the thicker blade will solve the problem. Indications are that it does indeed solve the problem. We have well over 400 hours now accumulated on the thicker blades in a fan component rig and the second engine is running with the thicker blades very successfully. The engine has produced specification thrust in both intermediate power and afterburner and has produced specification thrust in specific fuel consumption.

Mr. CROMWELL. That is a little unusual for the first 400 hours of any new engine, isn't it?

Captain LENOX. It is very unusual. We were quite cautious about it because this spec performance was produced on the first engine. It was proven to be no fluke however, when the second engine began running it also produced required performance.

Mr. CROMWELL. Do you project any growth then between now and the maturity of the engine?

Captain LENOX. We would project that the fact that it is producing specification performance now gives us a much greater opportunity to work on durability and reliability problems in the engine and that is going to be the focus of our efforts during this development program. Another yellow flag area that I have is the radar development. We have put a radar test bed in the program to improve our visibility on that development and to lower the risks, but it is one of the more complex systems in the aircraft and I think it deserves our close attention and we are giving it that.

Digitized by Google

Mr. CROMWELL. How far behind schedule is the radar program at this point in time?

Captain LENOX. Slightly behind schedule at this point but it is very early in the development program of the radar. They will be fluctuating in their schedules as they go along.

Mr. CROMWELL. How far behind——

Captain LENOX. Two to three weeks.

F–18 AIRPLANE PERFORMANCE

Mr. CROMWELL. How does the performance of the F–18 situation compare to the F–4 as a fighter? Could you give us an updated table for the record which would take today's figures with the F–18 and compare them with the F–4?

Captain LENOX. Yes, I will be glad to. I might add it is substantially better.

A performance comparison between the A/F–18 and F–4J/S is shown below:

Performance	F–18A	F–4J/S
Fighter aerodynamic performance MO.9, 10,000', F/A–18A: (2) AIM–9+(2) AIM–7; (4) AIM–7:		
Specific excess thrust, Ps	[Deleted.]	
Sustained turn rate, °/sec	[Deleted.]	
Sustained load factor, g	7.5	6.1
Acceleration (0.8–1.6M, 35,000'), sec	[1] 98	124
Fighter escort radius, nm	417	322
Combat ceiling (intermediate power), ft	49,400	41,100
Minimum carrier approach speed, kt	127	146
Radar detection range, 5M², R_{90}:		
Head-on, look down, nm	[Deleted.]	
Tail-on, look down, nm	[Deleted.]	
Air-ground weapon system delivery CEP, mils	[Deleted.]	
Operational readiness (percent)	80	45
Reliability, mean flight hours before failure	3.7	9.0
Maintainability, direct maintenance man-hours per flight-hour	18	38
Average unit operating and support costs, fiscal year 1975 dollars, 35 flight-hours per month, millions of dollars per aircraft per year	0.76	1.03

[1] Structural limit.

Mr. CROMWELL. Also would you compare the latest performance calculations on the A–18, compare them to the A–7?

Captain LENOX. Yes sir.

[The information follows:]

A performance comparison between the A–18 and A–7 is shown below:

Performance	A–18	A–7
Attack aerodynamic performance, MO. 7, SL, F/A–18: (4) MK–83 plus (2) AIM–9 plus (3) TANKS plus FLIR/LST. A–7E: (4) MK–83 plus (2) AIM–9 plus (2) tanks plus FLIR POD:		
Sustained turn rate, degrees per second	[Deleted.]	
Sustained load factor, g	4.9/6.8	2
Strike interdiction mission (Hi-Lo-Lo-Hi) (radius in nautical miles):		
(4) MK–83 plus (2) AIM–9	[Deleted.]	
(8) MK–83 plus (2) AIM–9	[Deleted.]	
(9) MK–83 plus (2) AIM–9	[Deleted.]	
Maximum speed at sea level, M	45,300	42,000
Maximum catapult weight	18	42
Operational wind-over-the-deck, kt	80	60
Operational readiness (percent)	3.7	.9
Realiability, mean flight hours between failure	18	24
Maintainability, direct maintenance man-hours per flight hour	.76	.86
Average unit operating and support cost, fiscal year 1975 dollar, 35 flight hr per month (millions of dollars per aircraft year)		

Digitized by Google

Mr. CROMWELL. Your first flight is sheeduled for—when is it?

Captain LENOX. September 1978.

Mr. CROMWELL. Is McDonnell presently on schedule to meet that first flight date?

Captain LENOX. Yes sir.

Mr. CROMWELL. Except for the radar are there any other behind schedule areas in theR. & D. program at this time?

Captain LENOX. The center fuselage area is running 3 to 4 weeks behind schedule and there is a plan to bring that back in schedule by late this calendar year. There are no other significant areas where we are running behind schedule.

Mr. CROMWELL. That is not an abnormal situation is it, early in the development?

Captain LENOX. No sir. Overall we are very pleased with the progress being made in the development program.

CHANGE TO F-18 SCHEDULE

Mr. CROMWELL. What was the cause of the overall change in the R. & D. schedule between last year and this year? The R. & D. development program?

Captain LENOX. The overall R. & D. development program has changed in two ways. One the schedule which we discussed—2 months rescheduling—and that was the result of the funding profile incompatibility during 1977 and 1978 in which the contractor would have to do more work than we had funds available to cover if he were to meet a July 1978 fly date.

We restudied the program and rescheduled by 2 months. This was the required rescheduling to stay within our current funding profile in the near years. We have shown also in our SAR and in congressional data sheet and in the presentation today an increase of approximately $140 million over last year's budget in the funding for the development program. That reflects a decrease during the year due to Navy and SECDEF budget decisions and an increase totaling $155.6 million which is applied in the out years, fiscal years 1979 through 1982. And that is an increase in the total R. & D. program. That increase is predominantly incident to the final definitization of our contracts for the airframe and the engine.

CAUSES OF COST CHANGES

Mr. CROMWELL. Would you provide a breakdown of that R. & D. increase to show how much is due to new scope of work, how much is due to program sheedule change, and how much is revised escalation and any other factors that might be pertinent?

Captain LENOX. Yes sir, I will provide a complete breakdown of that $155.6 million.

Digitized by Google

[The information follows:]

A breakdown of the $155.6 million increase in R. & D. for fiscal year 1979 through fiscal year 1982 is shown below (then year dollars, millions):

Contract Definitization	$134.1
Estimating adjustment	52.3
Escalation	31.1
Schedule adjustment	20.7
Subcontractor awards/payments	30.0
Additional funding requirements	21.5
Weapons integration test support	8.0
Operational mission environment	9.5
Testing Rockets	4.0
Total	155.6

Mr. CROMWELL. Also, would you give us a detailed breakdown of the procurement cost decrease for the record?

Captain LENOX. We have procurement cost decrease of $155.3 million. The flyaway portion of that is decreased due to the reduction in lot 3 aircraft from 15 to 9, the accelerated deliveries in the Secretary of Defense budget decision in September 1978 which increased our maximum production rate from 9 to 11 aircraft a month in the out years, and the deletion of 1 of the 2 trainer versions. Support costs vary both plus and minus and I can provide you a detailed breakdown for the record on a number of the items that make up that difference.

Mr. CROMWELL. Just the net would be adequate. If you could provide for the record a table that would give me, net, some of these different factors.

Captain LENOX. We will provide for the record a summary of flyaway, support, and spares changes.

Mr. CROMWELL. And escalation.

Captain LENOX. And the escalation factors, yes sir.

[The information follows:]

A breakdown of the $155.3 million decrease in procurement is shown below:

Procurement (APN)	Then year dollars [1]	Fiscal year 1975 dollars	Difference due to escalation
Flyaway:			
Decrease lot III from 15 to 9	+44.2	+6.6	+37.6
Accelerate deliveries	−137.8	+5.3	+132.5
Common trainer	−5.0	−2.7	−2.3
Support:			
Airframe and engine PGSE	+44.8	+37.4	+7.4
Avionics PGSE	−41.8	−22.7	−19.1
Peculiar training equipment	+36.2	+17.5	+18.7
Publications/technical data/training/ILS	−1.5	−1.4	−0.1
Spares:			
Engines (365 to 315)	−58.5	−34.0	−24.5
Spare parts	−35.9	−22.3	−13.6
Total	−155.3	−26.9	−128.4

[1] Escalated.

ADVANTAGES OF COMMONALITY

Mr. CROMWELL. Senator Thurmond was questioning you on the commonality between the attack and the fighter version. What are the advantages of your drive toward commonality. What are the advantages toward the Navy?

Captain LENOX. A very major advantage lies in the fact that we require only one software support system. The support of software is an extremely expensive effort. It is for this reason that the Navy has

Digitized by Google

embarked upon the AN/AYK-14 computer so as to achieve commonality in computer software support. Through this commonality effort we have as stated earlier, a single software program in the aircraft. That will achieve obvious savings in software. The logistics savings in hardware will accrue because of purchasing only one component instead of two unique aircraft applications, and thirdly it provides a flexibility within the carrier air wing so that simply through attaching different array of ancillary equipment on the aircraft as external scores the aircraft can fulfill various missions.

Mr. CROMWELL. Will the attack version be able to fire the Sparrow missile?

Captain LENOX. Yes, sir, if the Sparrow launchers are installed. The basic wiring and basic capability is built into the airframe.

Mr. CROMWELL. So the airplane will be adaptable and flexible?

Captain LENOX. Yes, sir. We anticipate that the attack version in a matter of a few hours could undergo a configuration change where the adaptors for the forward-looking infrared and laser-tracking pods could be removed and Sparrow launchers installed. We required those adaptors be designed to attach to the same fittings that will hold the Sparrow launchers in the fuselage stations.

Mr. CROMWELL. When you work towards commonality did you give up any combat capability, any tactical capabilities?

Captain LENOX. I am not aware of any tactical capability at all that we have given up to achieve this commonality.

COMPARISON OF F-18 SCHEDULE TO F-14, F-15, F-16

Mr. CROMWELL. The charge has been made that the F-18 program is too accelerated and too concurrent. On the other hand, your presentation makes it appear that it is very orderly and in fact almost stretched out in the development phase. Would you provide a comparison of the R. & D. and your early production schedule milestones for the F-18 as compared to the F-14, the F-15 and the F-16?

Captain LENOX. Yes, sir.

Mr. CROMWELL. Would you do it this way for the record. I would like you to start with the prototype award milestone where that applies and then give us the full scale development contract and the number of months to first production delivery, 30 production delivery and 100 production delivery. I believe it would show that the F-18 is slower paced than all of those other airplanes.

Captain LENOX. Yes, it is.

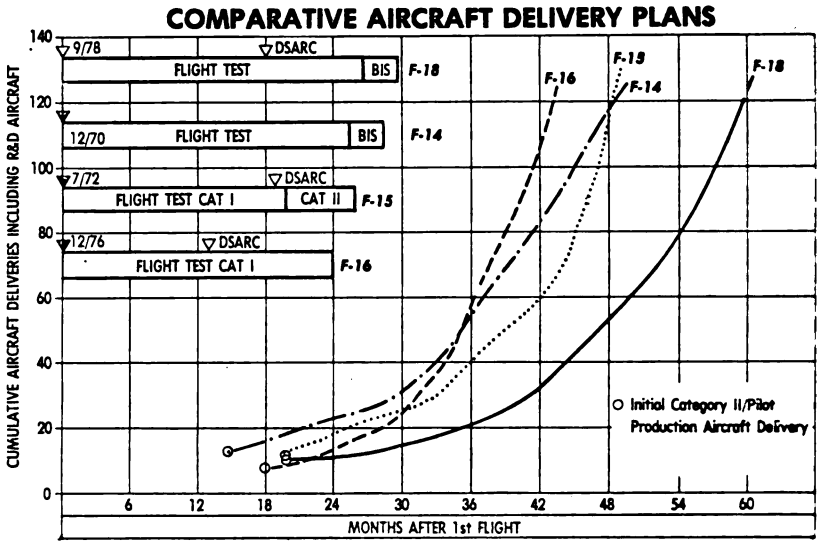
[The information follows:]

The following table shows significant contract milestones with production deliveries keyed to FSD contract award:

			Months to		
	Prototype contract award	FSD contract award	1st Production aircraft	30th Production aircraft	100th Production aircraft
Aircraft:					
F-14	Not applicable	February 1969	37	56	69
F-15	do	December 1969	51	68	79
F-16	April 1972 (YF-16)	January 1975	41	57	65
F-18	April 1972 (YF-17)	January 1976	52	79	93

Note: The chart displays graphically the FSD/Procurement Programs for these aircraft with production deliveries keyed to first flight:

Digitized by Google



Mr. CROMWELL. Is Lt. Comdr. Monroe Smith here?
Commander SMITH. Yes, sir.

FLIGHT TESTS ON F–18 PROTOTYPE

Mr. CROMWELL. Would you come up, please. Would you identify for the record and say what your present job is in the Navy?

Commander SMITH. I am Lt. Comdr. Monroe Smith, commanding officer of the Navy Fighter Weapons School at NAS Miramar, Calif.

Mr. CROMWELL. Did you fly the Northrop YF–17 prototype?

Commander SMITH. I flew it the first week of March for 2 days; the first and second of March.

Mr. CROMWELL. How many flight hours did you have?

Commander SMITH. I had a total of six flights totaling 4.7 hours flight time.

Mr. CROMWELL. What was your impression of that airplane as a potential fighter?

Commander SMITH. I was very much impressed with the airplane because of its high thrust-to-weight ratio and its high maneuverability. Every fighter pilot wants more thrust and will accept the penalties of less gas; but that is speaking from a personal point of view. The Navy has always had to accept an airplane that was a little underpowered relative to thrust/weight because of the increased weight requirements associated with landing aboard ship. We have always paid a price for carrier suitability in terms of thrust to weight in our fighters.

Mr. CROMWELL. How did the performance of the prototype compare with the other Navy fighters that you have flown, or any other fighters?

Commander SMITH. Sir, I have flown everything from the F–86H to the F–14. In the Navy Fighter Weapons School we fly A–4 Echoes—

Digitized by Google

we have the F–5E's and of course the T–38. I have flown the F–14 for more than 500 hours and I have over 100 carrier landings in that airplane.

Mr. CROMWELL. Have you ever flown the F–4?

Commander SMITH. I have over 2,000 hours in the F–4 both as a pilot and as a naval flight officer. I have over 300 carrier landings in the F–4.

Mr. CROMWELL. If you had to fly the F–18 against the F–4 how would they do against each other?

Commander SMITH. There is no real comparison to be made here. If you are talking about a day visual engagement, as I saw the YF–17, it is superior to any tactical fighter we have in the Naval inventory. If you are talking about a day visual air-combat engagement; commencing from a head-on pass at 15,000 feet, 400 knots—or you pick the initial conditions—in a one versus one sterile environment, the YF–17 will be superior every single time.

Mr. CROMWELL. Would it beat the slatted F–4?

Commander SMITH. Yes, sir.

Mr. CROMWELL. How about the F–14?

Commander SMITH. It will beat the F–14.

Mr. CROMWELL. Hands down?

Commander SMITH. In my opinion; yes, sir.

Mr. CROMWELL. What was the overall purpose of your flight evaluation?

Commander SMITH. Well, sir, I am commanding officer of Navy Fighter Weapons School and we have no charter to evaluate new hardware or equipment. We instruct postgraduate level tactics in fleet fighters. However, my background is such that I have enjoyed a tour in air test and evaluation squadron 4 and was the F–14 project officer from 1971 through 1973. I do understand operational evaluation and I flew these flights to assess the tactical applicability of the YF–17 as it existed in the prototype in the day VFR environment. I felt that I could give my opinion on flying qualities and performance as a graduate level fighter tactics instructor but not as a test pilot. I am not a designated test pilot.

Mr. CROMWELL. Did you write a report on your flights?

Commander SMITH. Yes, sir. I did write a report. It was in the form of a letter from my Command to the commander, Fighter Airborne Early Warning Wing Pacific.

Mr. CROMWELL. No copies?

Commander SMITH. No copies.

Mr. CROMWELL. Would you give us a summary, a verbal summary?

Commander SMITH. Yes, sir, it laid out the statistics of the flights. They were flown on the first and second of March. Two flights were flown out of Miramar and four flights out of Yuma, Ariz. Two flights took place over water in a warning area utilizing my F–5E aircraft as chase, target, and adversary. The four flights in Yuma took place on the air-combat maneuvering range and utilized two F–5E's versus me in the YF–17. I pitted myself against my own expert tactics instructors in F–5E's for four flights. Basically those four flights were "no holds barred, the sky is the limit, and call it like you see it."

Digitized by Google

Mr. CROMWELL. Did you win?

Commander SMITH. Quite frankly, I got shot every single time. And this is nothing more than what we have seen everytime we heavily engage in a turning dogfight given a multitarget environment against small airplanes that you can't maintain sight of. As long as I attempted to keep both aircraft in sight I could control the fight very easily. When I decided to go in for a gun attack on one fighter, that left the other airplane free to maneuver to my "blind side" for an attack. During the last flight it took 4 minutes for this to happen. During that extended engagement I fired a number of high angle gun shots prior to being shot myself with a simulated missile. But we are talking now of tactics and not aircraft performance. My job was to assess every aspect of the airplane in simulated combat which, by design and intent, placed it in an environment where it couldn't survive.

Mr. CROMWELL. Right. Have you flown the A-7E?

Commander SMITH. Yes, sir; I have flown over 50 hours in the A-7E and I have had some number of practice bombing missions with the airplane.

Mr. CROMWELL. How do you assess the performance, the advantages of the A-18 as shown in the prototype over the A-7E? What performance advantages would it have and how do you feel they would be useful tactically?

Commander SMITH. The A-7E is a very effective bomber. No one doubts that. However, it is underpowered in my opinion. The YF-17 with the extremely high thrust to weight ratio that it enjoys—of course I am talking about in the fighter version and I am not sure what the thrust to weight is in the attack version—I would have to get that from Captain Lenox and performance assessment would only be conjecture on my part.

Captain LENOX. It is the same.

Commander SMITH. He says it is the same. However, the A-7, once it is loaded with bombs can barely maintain [deleted] knots indicated airspeed at 15,000 feet. It certainly can't execute defensive maneuvers without jettisoning it's external stores. We fly against the A-7s, seven times a year at the Navy Fighter Weapons School. Once the A-7E comes under attack by the F-5E, it cannot get away. We kill him every single time. The F-5E is a very close simulator to the MIG 21. If a MIG-21 jumps an A-7 with intent to shoot him, the A-7 driver is going to get it! It is that simple. This is due in part to the fact that the A-7 is a subsonic airplane. The YF-17, of course, could jettison ordnance and go supersonic among other things. Also the A-7, once forced to execute a high G break against a SAM, or whatever—a missile break to defeat an air-to-air missile—will quickly lose altitude and/or air speed. Without thrust to weight you cannot maintain air speed and altitude so you either have to jettison bombs in my opinion, or you have to be shot or you have to go down to a very low altitude and hope you are no longer under attack. In any case, it is my opinion that high thrust to weight is needed in the attack airplane, not just to go supersonic but to ingress and egress from a target with high speed, good maneuverability, and hopefully, increased survivability. I do believe this increases survivability as well as combat effectiveness.

Mr. CROMWELL. Thank you very much, Commander.

Digitized by Google

MARINE CORPS NEED FOR F–18

General Miller, how important is the F–18 to meet the Marines' fighter needs in the eighties? What would happen if something got off track and you did not get the F–18?

General MILLER. As presently computed we would estimate we would maintain force structure of our 12 plane UE fighter attack force until about the 1987 to 1988 time frame. At that time we would start experiencing a shortfall in our fighter/attack force.

Mr. CROMWELL. You are talking about your F–4 fighter?

General MILLER. Yes. Our F–4 fighter/attack force.

Mr. CROMWELL. If you did not get the F–18 you would have to stay with F–4's until 1987 or 1988?

General MILLER. Correct. Between 1987 and 1988.

Mr. CROMWELL. Would that include transferring the Navy's F–4's to the Marine Corps. Does that run the Navy Department out of F–4's at that time?

General MILLER. I believe that is correct. The reason I gave the wide range in dates is because it would be dependent on a number of factors. Attrition, the number of aircraft Navy retained in the Navy inventory, et cetera. So we would estimate it would be in the 1987–88 time frame that we would be unable to maintain force structure.

Mr. CROMWELL. What would you do at that point in time for fighters if there was no F–18 program?

General MILLER. We have given some consideration to the problem that we would be faced with. A number of factors make it difficult to answer that definitively at this time but we would have to consider possibly returning the F–14 program to fill the gap between the time that the type B V/STOL fighter would become available and I believe that is currently projected for about mid-1995.

Mr. CROMWELL. Do you believe the Marine Corps needs the fighter capability that Commander Smith talked about in the F–18 to meet the threat in the early-to-mid eighties?

General MILLER. Yes, sir. We need a fighter capability which complements that of the Navy. It enables the amphibious forces to support themselves in the fighter role and does not tie down the carrier to support an amphibious operation after the amphibious operation has ceased and operations continue ashore.

Mr. CROMWELL. That is why you want to have a fighter capability but what I really wanted to drive to was, do you believe you need the advanced capability that the F–18 is going to give you, or do you think you can survive in the mid to late 1980's using F–4's?

General MILLER. We feel very strongly that we need some modernization over the F–4 and consequently the F–18 is a very important program to the Marine Corps.

Mr. CROMWELL. Do you like the looks of the program?

General MILLER. Very much, sir.

NAVY SUPPORT OF F–18

Mr. CROMWELL. Admiral Turner, do you support the need for the F–18 program?

Admiral TURNER. Yes, sir; I surely do. I see it as a valuable adjunct and again a complement to the F–14 as the low part of the

Digitized by Google

high-low mix in the fighter force of the late 1980's and 1990's.

Mr. CROMWELL. Thank you very much.

F–18 DELIVERY SCHEDULE

Mr. OLD. I believe any of you gentlemen can answer these questions if you would, please. What is the planned delivery schedule of the F–18 to the Navy and the Marine Corps and the purpose of the question is to find out whether it is consistent with the F–18 statement about the need to replace the aging F–4 fighter, especially in the Marine Corps.

Who gets the first one, does the Navy get them or the Marine Corps?

Admiral TURNER. The Marine Corps gets the first aircraft. After the first prototype and development aircraft then we start outfitting the Marine Corps. They get the first 5 in 1981—these are all fighters—24 in 1982, 30 in 1983 and so forth. The Navy does not get fighters until—we are a year behind the Marine Corps in the introduction of fighters.

Mr. CROMWELL. So, in the delivery of the fighters, the Marine Corps has priority?

Admiral TURNER. That is correct.

CONFIGURATION COMMONALITY IN F–18

Mr. OLD. I am sure this has been answered, but were there significant differences between the Navy and the Marine F–18 aircraft?

Admiral TURNER. No, the only difference between the Navy and Marine F–18 in the basic airframe-engine combination lies in the communication system. The Navy aircraft will be delivered with two UHF radios and in order for the Marines to communicate with the forward air controllers on the ground one of those two radios is removed and replaced with VHF in the Marine aircraft. The Marines will, however, have a different external suite of stores.

Mr. OLD. Do the Marines eventually get an A–18?

General MILLER. No sir, we do not. There is adequate attack capability in the fighter version for us. Primarily our emphasis in the fighter version was to be sure we had the capability to fire standoff weapons; that is, electro-optical and laser-guided weapons in the attack role. Since our fighter attack force of fighters provides 41 percent of our total attack capability this is a very important requirement for us.

Mr. OLD. What is the difference, then, between the Marine F and the Navy A?

Captain LENOX. The Navy A has a moving map display in the cockpit. Neither of the two fighters have that display. The Marine aircraft has the one VHF, one UHF radio. The Navy fighter has two UHF radios and no moving map display. Those are the only configuration differences in the basic airframes.

Mr. OLD. Darned if I see why we seem to be ending up with three airplanes. If the Marines can attack the same kind of ground and possibly sea targets that the Navy may be going after, why can't the airplanes be the same?

Digitized by Google

Admiral TURNER. It is essentially 99 percent the same. There are a few small differences to add to the Marine capability for both fighter and attack functions and to distinguish between the fighter and attack versions in the Navy. As Captain Lenox indicated, with minor modifications and changes, it is the same airplane except for 1 or 2 percent.

Mr. OLD. Would there be any reduction in the program cost if you used the same airplanes for all three of these missions, Navy fighter, Marine fighter, and Navy and Marine attack?

Captain LENOX. There would be a slight increase due to the cost of the moving map display that would go in all the airplanes and that is a very easy change to make. It is a capability that is very nice to have for the fighter community but is not required and would cost us $70,000 or $80,000 per aircraft.

Mr. OLD. But moving map display was for Navy attack.

Captain LENOX. Yes sir, but if you make all the aircraft the same we would put the moving map display in because the Navy attack community needs that for their nuclear missions and their long range attack missions.

Mr. OLD. Now you are getting into the crux of it. Why the Navy has to be given—is it strictly different because of this long range attack, whatever that means, in the nuclear mission?

Captain LENOX. The Marines say that they do not need the moving map display in order to conduct an attack.

General MILLER. Mr. Old, maybe I can enlighten you as far as the Marine requirement in the moving map display. The attack capability which the Marine Corps seeks is a shorter attack mission basically limited to the close air support type of attack targets and generally nothing any deeper than about 300 miles. Therefore, we are in a much shorter attack field and feel we could save the type of funding that was required in the moving map display. If somebody wishes to give us the funds we will be glad to put it in there, though.

Mr. OLD. Thank you.

Off the record.

[Off the record discussion.]

CAUSES OF PROCUREMENT COST DECREASE

Mr. OLD. Referring to the procurement cost estimate changes, what are the details of the accelerated deliveries as directed in a Secretary of Defense budget decision in September 1976?

In arriving at this reduction you give three things: Accelerated deliveries, a more detailed definition of program support and spares requirements, and life cycle cost trades.

What I am looking for here is breakout of how each of those contribute to the $155 reduction?

Captain LENOX. The decrease in lot 3 aircraft from 15 to 9 caused overall increase in the procurement program of $44.2 million and is due to taking 6 aircraft out of early year and putting them on the end of the production line to keep the total at 800. Accelerated deliveries, the 9 per month to 11 per month production rate in the out years, reduced the procurement account by $137.8 million and the

Digitized by Google

trade which resulted in deleting one of the two trainer configurations was a reduction of $5 million.

Mr. OLD. So the biggest cost reduction item was?

Captain LENOX. Accelerated delivery schedule.

Mr. OLD. Admiral Turner, has there been any change in validity of the requirement for 800 F–18's and A–18's?

Admiral TURNER. At this point, no, sir.

IMPACT OF F–18L ON PROGRAM

Mr. OLD. What impact would the F–18L program have on Navy's F–18 program?

Admiral TURNER. The F–18L program is separate and distinct from either the F–18A or the A–18 programs so there would be no interference with the Navy's programs. Should the F–18L program eventuate there could be a savings to the U.S. Government in terms of development costs, procurement scale costs, that would be to our advantage. But as far as interfering with the program slowing it down or speeding it up, no effect there.

F–18 DEVELOPMENT SCHEDULE

Mr. OLD. Captain Lenox, in your statement you stated that as a part of contract definitization and in order to avoid an incompatibility between planned funding profiles and work schedules, the first flight slipped 2 months. How did you get into this situation?

Captain LENOX. We got into that situation, Mr. Old, by being required to live within the previously identified funding profile in the near years. We were constrained to live with our 1978 budget rather than ask for more money in fiscal year 1978. At the time that decision was made it appeared that we could do that job. As we got deeper into the program and began to analyze and plan it more deeply we realized we could not.

Mr. OLD. When will the F–18 production per se actually begin? Senator Goldwater keeps asking the question, "When is it you are going to cut metal?"

Captain LENOX. For the R. & D. airplane?

Mr. OLD. Yes.

Captain LENOX. We are cutting metal today. The engine as I mentioned, is already running and we are cutting metal today on the major bulkheads for the center fuselage area.

Mr. OLD. Senator Goldwater was provided a paper on this by Navy liaison. Would you agree with this regarding F–18 production and when it would start: "Probably late this year first R. & D. aircraft will start being assembled at McDonnell-Douglas. No metal being cut so to speak yet at McDonnell-Douglas. However, subs are building various parts." Is that a fair statement?

Captain LENOX. Yes sir, that is correct.

F–18 RADAR PROGRAM

Mr. OLD. I want to talk about the F–18 radar which you indicated to Mr. Cromwell was an item you were looking at closer than you might normally. What are the estimated developments costs for the radar?

Digitized by Google

Captain LENOX. $76 million.

Mr. OLD. Do you have an estimate at this time of the unit cost of the radar?

Captain LENOX. No sir. I can provide that for the record.

[The information follows:]

Based on procurement of 800 F-18 Aircraft, the unit cost of the radar is estimated to be $365K in fiscal year 1975 dollars. This translates into $638K in escalated dollars.

Mr. OLD. If you would, please. Is there any way you can compare this radar development program to other radar development programs that the Navy has been associated with? The reason I asked the question is that during previous testimony you were asked questions about why a specific new radar was required and the Navy justified that. However, I don't believe we ever got into how the development cost of this program is proceeding as compared to the development cost of other radar programs.

Captain LENOX. Mr. Old, I cannot speak to development cost of other aircraft programs but I can speak to the reliability and design features, I think, in some other radar programs.

Mr. OLD. Admiral Turner, is it possible at this particular point to maybe just provide a kind of short analysis of how this radar development program does compare with others. It was difficult for me to understand in part why a whole new development program was required for a radar although I believe maybe you explained it reasonably well. But I will leave it at this. If you feel something further could be added to clarify this point, please do so. Will this be satisfactory?

Admiral TURNER. I will be happy to provide it for the record.

Mr. OLD. I am talking about if you care to add something more to this particular comment, please do so.

Admiral TURNER. Fine.

[The information follows:]

The F/A-18 radar design philosophy differs from predecessor systems for several reasons. First, the Navy has placed increased emphasis on reliability and maintainability. Reliability is being designed into the radar at the conceptual and circuit design stages in order to enhance Fleet readiness by providing a radar more than twice as reliable as current designs. In addition, stringent NAVAIR reliability development specifications utilizing the Test Analyze and Fix philosophy are imposed as a contractual requirement. Instead of testing to a military standard environment in the laboratory, conditions more closely representative of the operational environment are being utilized. These tests, known as OME (Operational Mission Environment) tests, were not conducted on either the AWG-9 or AWG-10 radars. Second, the F-18A/A-18A radar is unlike its predecessors in that there is one common radar that will perform both air-to-air and air-to-ground missions. This dual capability is required by the multimission design of the F/A-18 and is provided by the programmable signal processor and the radar data processor. Third, the F/A-18 is the first aircraft procured by the Navy with Design-to-Cost requirements, whereas performance was the primary consideration in most program decisions in previous aircraft and radar developments.

PERFORMANCE OF F/A-18

Mr. OLD. The following questions relate to the F-18 and the A-18. For the A-18 does the requirement to carry external fuel tanks limit the number of weapons that can be carried.

Captain LENOX. Yes sir as in all aircraft.

Digitized by Google

Mr. OLD. To what extent is it limited?

Captain LENOX. We have five external storage stations on which we can carry bombs or smart weapons. Three of those stations also are capable of carrying external fuel tanks. So one could load the airplane in any combination of tanks and stores to use those five stations. In addition we do carry our forward looking infrared set on a pod attached to the SPARROW well in the fuselage, therefore we do not require the use of an external store station for that capability.

Mr. OLD. If you were carrying three external fuel tanks would you carry either a VER or a TER rack on the other stations?

Captain LENOX. If we were carrying three external fuel tanks our current plan is to carry a two-station rack called VER. We could put a TER on that station, but the drag penalty would be rather high.

Mr. OLD. So the lineup could be three external fuel tanks and two vertical ejection racks which would be carried, capable of carrying what load?

Captain LENOX. They can carry up to 2,500 pounds of stores. Any combination, one or two ballistic bombs, or smart weapons.

Mr. OLD. You can carry—what combination of weapons could you get on that rack that would equal 2,500 pounds, one MARK-84 for example?

Captain LENOX. One MK-84 plus an adaptor would be less than 2,500 pounds. We can also carry a Walleye II on that station.

Mr. OLD. What sort of inventory ratios, fuel tanks to aircraft for the A-18 are you thinking about at this time?

Captain LENOX. We are thinking about five pylons for F-18 along with five of the bomb racks. This is the super 14-30 bomb rack that is installed in that pylon. Four vertical ejector racks, two AIM-9L Sidewinders and two Maverick launchers. And one FLIR set for two aircraft.

Mr. OLD. How about fuel tanks?

Captain LENOX. Two fuel tanks for each A-18.

Mr. OLD. If you considered the normal combat radius of the F-18 was going to be approximately 250 miles and you had reasonably hard targets, conventional wise, to try to destroy, how many fuel tanks would you expect to have to carry on that mission?

Captain LENOX. I expect to use one or two smart weapons and I don't anticipate I would carry any fuel tanks. Perhaps one.

Mr. OLD. On a 250-mile radius mission no external fuel tanks would necessarily be required assuming you were in combat area for ten minutes?

Captain LENOX. I can have that calculation performed and provide it for the record if you wish. My feeling at this point is no external tanks would be required for that specific mission.

ORDNANCE FOR A-18

Mr. OLD. Will the A-18 be able to carry all the ordnance that the A-7E can carry?

Captain LENOX. All by types?

Mr. OLD. All by type.

Captain LENOX. Yes, sir.

Digitized by Google

Mr. OLD. Without a special adaptation the A–18 comes off the line and you have an A–7E with all its ordnance possibilities lined up, like on a static display on a ramp, and you say the A–7E or the A–18 can carry any combination of these?

Captain LENOX. Yes sir, to the best of my knowledge it can carry all of those plus the Mavericks which I think the A–7E does not carry.

Mr. OLD. There are no pods or dispensers or anything like that?

Captain LENOX. With the data link weapon you have a pod that goes with it so that is part of the same basic array you have in front of the A–7E.

Mr. OLD. Can the A–18 carry the Walleye extended range data link?

Captain LENOX. Yes, sir.

Mr. OLD. It can carry a Shrike?

Captain LENOX. We are not putting Shrike on.

Mr. OLD. The A–7E, can it carry the Shrike?

Captain LENOX. It can carry the Shrike. We will be integrating the Harm into the A–18. We could put the Shrike on the aircraft—but it is not called out with the requirement——

Mr. OLD. You are betting on the time period and the development of the Harm in looking at what the threat is going to be?

Captain LENOX. Yes, sir.

Mr. OLD. Will it have the same ECM suit as the A–7?

Captain LENOX. We will have the ALR–45 and ALR–50 and the ALQ–126. To the best of my knowledge, those units are the units that are in the A–7E.

A–7E COMPARED TO A–18

Mr. OLD. Is it a fair statement to say that the A–18, even with three fuel tanks, doesn't have the same combat radius as the A–7E?

Captain LENOX. Mr. Old, you can define your mission and make the A–18 look better than the A–7, or you can make the A–7 look better than the A–18.

I think it is only fair to say, if you took a cross-section of all missions, you would find that the A–7 can carry a large load a little bit farther than the A–18. However, there is a danger, in my judgment, in comparing aircraft on only the max range for a single mission or sortie.

Readiness is a state of health and it requires repeated trips to the target area, and the ability to have other airplanes available, to turn them around quickly, and to survive in a combat arena. When all of those things are racked into the airplane capability, you will have a much finer attack airplane, without a doubt.

Those considerations were taken into account in the initial requirements, when they were laid down, for the A–18.

Mr. OLD. Admiral Turner, I want to compliment Captain Lenox on being a superior spokesman for the F–18. I think he has done a fine job with the committee and with this staff. I have enjoyed working with him. He just got on board this year, but it is a real pleasure to see a program manager that has the expertise about his program that I think Captain Lenox has.

Digitized by Google

OPERATIONAL USE OF A–18

I have one final question I would like to ask of you and that is related to the A–18 and the briefing you gave us on your operation in the Mediterranean. How would you have used the F–18, had hostilities broken out and what sort of combat ranges do you anticipate you would have been working with?

Admiral TURNER. First, on behalf of the U.S. Navy, I accept with pleasure the compliments for Captain Lenox, also on behalf of Admiral Petersen on my right, who is Captain Lenox's boss. We are pleased that he has done so well and is doing so well in running a very fine program.

If we can just bring the aircraft in now on cost, on time, on target with all the capabilities, I will be just delighted.

In the employment—I want to be sure I understand correctly. Are you talking about the F–18 or the A–18?

Mr. OLD. The A–18.

Admiral TURNER. If I had it during the Yom Kippur war, I would have employed it almost identically as I employed the A–7B's and C's that I had at that time. It was a confrontation and required a unique situation with aircraft overhead, different altitudes, different patterns constantly compounding and confusing the fire control solution of the opposing platforms.

I would also have used them on surface surveillance patrols. They would have certainly had the range and the capability and the navigational equipment and the like. At what ranges could we have operated? Certainly in the confrontation situation, range was no consideration. The problem was really time on-station, refueling, and keeping them up there to be responsive.

Had our mission been changed to support any kind of ground conflict, again, from what I know of the airplanes, I probably would have had the carriers as close as feasible to minimize the transit time to the combat zone and to enhance the load carrying capacity and capability of the aircraft.

Depending on the threat present at that time, I would have prudently moved the carriers further out to provide the defense in depth against any opposition and would have been comfortable with operating both the A–7 or the A–18 somewhere, as a practical matter, between 300 and 400 miles, in extreme cases, 500. Beyond that, it begins getting difficult.

I hope that gives you a feel for how I might have employed the A–18.

Mr. OLD. Very good. Thank you very much.

No further questions.

Mr. CROMWELL. Thank you, captain.

[A brief recess was taken.]

Mr. CROMWELL. The committee will come to order.

Digitized by Google

F-14 PROGRAM REVIEW

Let's put Admiral Alvis' F–14 statement in the record, as if given.
[The prepared statement of Rear Adm. John Alvis follows:]

PREPARED STATEMENT BY REAR ADM. JOHN ALVIS, F–14 PROGRAM MANAGER

Good morning, Mr. Chairman and Members of the Subcommittee, it is indeed an honor and a privilege to brief you today on the Navy's F–14 program.

I have structured my presentation to cover the following areas: Requirement, description, milestones, force structure, program cost, readiness, the advanced engine, and current issues, I will conclude the presentation with a short summary.

11 MARCH 1977

REQUIREMENT

- THREAT TO CARRIER TASK FORCE
  - AIR-TO-SURFACE MISSILES LAUNCHED FROM MASSES OF ENEMY BOMBERS
  - ANTI-SHIP SURFACE-TO-SURFACE CRUISE MISSILE
- THREAT EXCEEDS TACTICAL PERFORMANCE OF OLDER NAVY FIGHTER AIRCRAFT
- F-14 MEETS THE NAVY'S FLEET AIR DEFENSE REQUIREMENT

The threats to be countered by the F–14A are a broad array of enemy aerial weapons, air-to-surface missiles launched from masses of enemy bombers [deleted] pose the primary threat to the carrier task force. The bomber/air-to-surface missile threat is compounded by the addition of jammers and escort fighter aircraft to the attacking force. [Deleted.]

Digitized by Google

[Deleted.] Another serious threat to the fleet is the anti-ship surface-to-surface cruise missile [deleted.] This broad spectrum of threats exceeds the tactical performance of our older Navy fighter aircraft which were first introduced to the fleet nearly twenty years ago. Their growth potential has been exhausted or is limited. The F–14A will meet the Navy's air defense requirement. No other fighter is available in the free world to match the total weapon system performance of the F–14A.

11 MARCH 1977

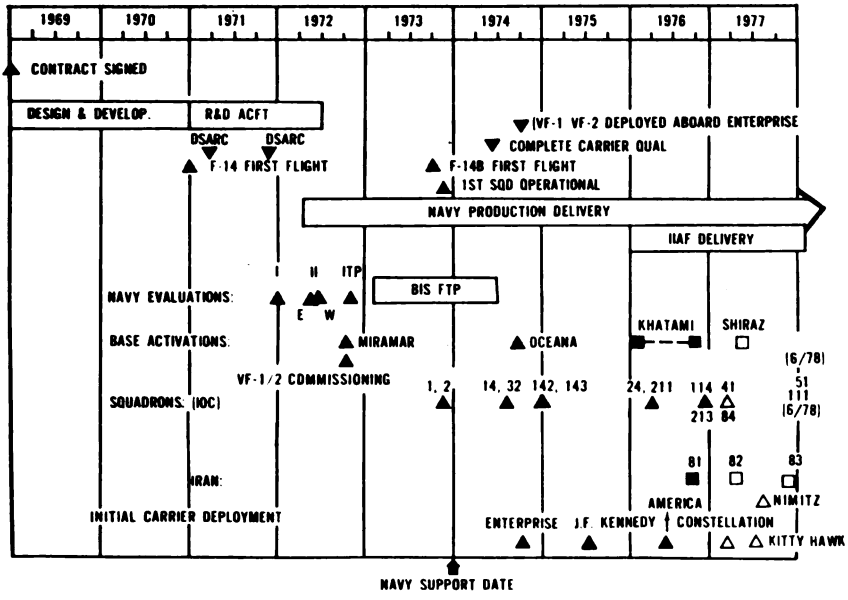
DESCRIPTION

- CARRIER-BASED
- TWO PLACE - TANDEM SEAT
- VARIABLE SWEEP WING
- SUPERSONIC
- MAJOR SUB-SYSTEMS
  - AWG-9 WEAPONS CONTROL SYSTEM
  - TF30-P-412 ENGINE
- LONG AND MEDIUM RANGE ATTACK
  - PHOENIX
  - SPARROW
- CLOSE IN AIR-TO-AIR COMBAT
  - SIDEWINDER
  - M61 GUN

The F–14A Tomcat is an all-weather, carrier-based airborne weapon system capable of performing air-to-air combat and air-to-surface attack missions. Featuring a two place-tandem seat and a variable automatic program sweep wing, the supersonic fighter is capable of engaging multiple targets simultaneously at altitudes from sea level to over 80,000 feet. The major subsystems of the F–14A aircraft are the TF30–P–412 engine and the AN/AWG–9 weapons control system. The Phoenix and Sparrow missiles provide the F–14 a long and medium range attack capability. The Sidewinder and M61 gun are utilized for close in air-to-air combat.

Digitized by Google

F-14 MILESTONES



The F–14 has been in production for approximately 5 years. 21 of the 80 aircraft procured for the government in Iran have been delivered in-country. The F–14 has successfully completed deployments aboard USS *Enterprise*, USS *John F. Kennedy* and USS *America*. Presently, the F–14 is deployed to the Mediterranean aboard USS *John F. Kennedy* and to the Western Pacific aboard USS *Enterprise*. Initial deployments are scheduled this year aboard USS *Constellation*, USS *Kitty Hawk*, and USS *Nimitz*.

FORCE STRUCTURE

END OF FISCAL YEAR	77	78	79	80	81	82
USN SQUADRONS	12	14				
UE (12 x NO. SQDNS)	144	168				
FRS UE	36	42				
RECCE UE	0	0				
TEST (VX-4/RDT&E)	15	15				
PIPELINE (30% THRU FY-78, 18% THEREAFTER)	55	61				
TOTAL AIRCRAFT REQUIRED	250	286				
TOTAL ACTIVE INVENTORY	237	264				
DELTA	-13	-22				

Digitized by Google

The current force structure plan envisions [deleted] F-14 squadrons by the end of fiscal year 1982. We project [deleted] aircraft in the inventory by the end of fiscal year 1982. The present plan is to utilize [deleted] aircraft through fiscal year 1982) as interim photo reconnaissance assets. The "interim photo role" was previously planned for the A-7. Further information on the F-14 photo role will be discussed in the reconnaissance briefing later this morning.

11 MARCH 1977

F-14A PROGRAM COST SUMMARY

($ IN MILLION)

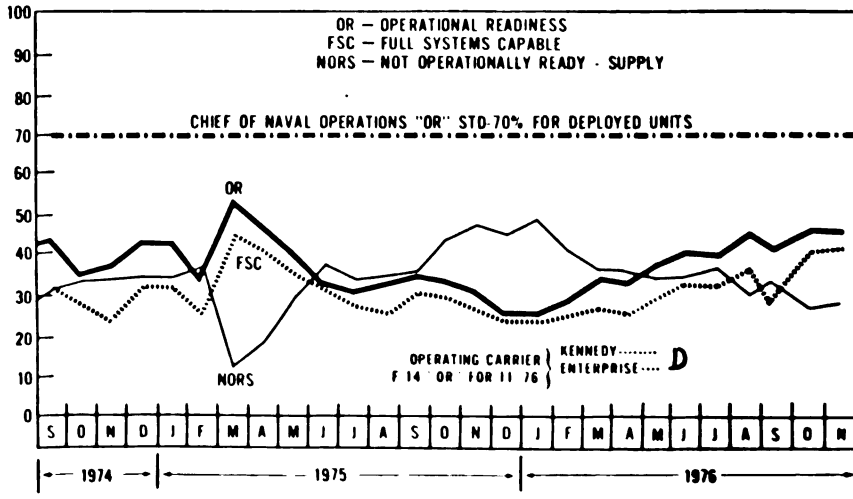
	FYTQ & PRIOR	FY 77	FY 78	FY 79	FY 80	FY 81	TOTAL
● QUANTITY	279 1/	36	44	60	60	42	521
● WEAPON SYSTEM COST	3815.0	684.9	907.3	1160.5	1155.3	738.9	8461.9
● INITIAL SPARES	383.4	16.0	33.4	47.7	60.0	56.4	596.9
● RDT&E	1112.1	15.0	-	-	-	-	1127.1 2/
● MILCON	8.9	-	-	-	-	-	8.9
● PROGRAM ACQUISITION COST	5319.4	715.9	940.7	1208.2	1215.3	795.3	10194.8
● PROGRAM UNIT COST	19.1	19.9	21.4	20.1	20.3	18.9	19.6

1/ INCLUDES 12 R&D AIRCRAFT

2/ EXCLUDES $369.2M IN F-14B DEVELOPMENT COSTS

This chart summarizes F-14 program costs. You will note that our total procurement quantity has increased from 403 to 521. Our fiscal year 1978 request to procure 44 aircraft is $907.3 million for the weapon system and $33.4 million for initial spares. The total fiscal year 1978 request is $940.7 million.

F-14A READINESS TREND



Digitized by Google

Now we will look at the F-14's material readiness record for the past two years. You will note that the CNO standard for deployed units is 70 percent. F-14 material readiness for all F-14s, both deployed and non-deployed was around 40 percent during the latter months of 1974 but declined as a result of our engine problems in early 1975. Our material readiness bottomed out in December 1975–January 1976. Material readiness has been rising through 1976. Current indications are that the latest squadrons to join the 6th Fleet are experiencing a material readiness rate in excess of [deleted].

Significant changes are being made to the TF30–P–412 engines. With the incorporation of these changes, we expect the material readiness to continue to improve.

11 MARCH 1977

ADVANCED ENGINE

- FY-77 BUDGET INCLUDED $15.0M
- NO FUNDING REFLECTED IN FY-78 BUDGET SUBMITTAL
- NAVY CURRENTLY PLANNING TO REQUEST EXTENSION:
  - HARDWARE DEMONSTRATION
  - SOURCE SELECTION

In fiscal year 1977, $15.0 million was inserted in the budget for a hardware demonstration and source selection for an advanced engine for the F-14. The Navy is currently examining the feasibility of a re-engine program in view of funding required and other high priority requirements. The $15M is being held by OSD. Should new engine funding be requested in the fiscal year 1979 budget, the Navy will then request an extension such that the hardware demonstration and source selection could be completed by the end of fiscal year 1978 vice 1977 as there is no funding in the fiscal year 1978 budget submittal for the advanced engine. Fiscal year 1979 funding is being addressed during the fiscal year 1979 planning and programming cycle now in progress.

Digitized by Google

CURRENT ISSUES

- ENGINE IMPROVEMENTS
- FIRE SURVIVABILITY
- REPROGRAMMING REQUEST (2ND INCREMENT)
- AIR INTERCEPT MISSILE EVALUATION/AIR COMBAT EVALUATION

As I mentioned earlier, we are making several changes to the TF30–P–412 engine. These improvements include a redesigned first stage fan blade, a redesigned third stage rotor, and engine containment. Furthermore, we are making several survivability changes to the airframe. Including a fire extinguishing system, the survivability changes will substantially increase the aircraft's ability to withstand combat damage. The significant engine and survivability improvements have been successfully tested and are currently being incorporated into production. These improvements are also being retrofitted into fleet assets. To finance the engine and fire survivability improvements, the Navy, in September 1976, requested and received congressional authority to realign $24.5 million in fiscal year 1977 funds. At that time, we advised Congress that the balance of the unfunded requirement would be the subject of a future reprogramming action after testing and evaluating the design fixes. Having successfully completed those tests, the second increment of reprogramming ($66.9 million) is in process and should reach the Congress shortly.

A joint Navy and Air Force evaluation (air intercept missile evaluation/air combat evaluation) is currently underway at Nellis Air Force Base. The objective of this evaluation is two-fold. The air intercept missile evaluation (AIMVAL) is comparing the operational utility of existing and proposed short range air-to-air missile seeker concepts. Meanwhile, the air combat evaluation (ACEVAL) is determining how the outcome of an encounter between specific aircraft systems is affected by the number of aircraft on each side. The F–14 is participating in this evaluation and testing is proceeding well to date. Of particular note, the new aircraft, delivered since January 1976, properly supported, have enjoyed a material readiness rate of in excess of [deleted] to date.

Digitized by Google

SUMMARY

- QUANTITY INCREASED FROM 403 TO 521
- $6.0 BILLION INVESTED THRU FY 77
- $4.2 BILLION ESTIMATED COST TO COMPLETE
- MATERIAL READINESS IMPROVING
- ADVANCED ENGINE UNDER REVIEW

In summary, the F-14A procurement quantity has increased from 403 to 521 aircraft. Approximately $6.0 billion has been invested thru fiscal year 1977. The Navy estimates that an additional $4.2 billion will be required to complete the program. Material readiness continues to improve as a result of our continuing material readiness improvement program. The advanced engine for the F-14 is being reviewed by the Navy and OSD.

F-14 FORCE LEVEL REQUIREMENTS

Mr. CROMWELL. Admiral Turner, the present F-14 procurement is planned for 521 airplanes. Will that provide enough airplanes to equip 24 squadrons, or enough for 12 carriers?

Admiral TURNER. No, sir. The Navy's plan is to equip 18 squadrons with F-14's and 6 squadrons with F-18's. However, an accelerated procurement plan was implemented this past year. There will be, for a 3-year period, enough aircraft to outfit 20 F-14 squadrons. After completion of the 3-year period, the number of F-14 squadrons will be reduced to 18.

Mr. CROMWELL. How many planes are needed in the inventory to support 24 squadrons?

Admiral TURNER. That will take a short calculation. If I may, I would like to put that in the record.

Mr. CROMWELL. My own figure was 432, but I am not too good at doing those calculations.

Would the Navy desire to go to an all F-14 fighter force?

Admiral TURNER. When the F-14 program was initiated, some years ago, that was the Navy's goal. As you are aware, the cost of aircraft is a consideration and a high-low mix was thought to be more affordable. Consequently, it resulted in the combined F-14/F-18 mix that we now envision for the late 1980's and early 1990's.

Digitized by Google

In response to your earlier question, the calculation is that for an operating force of 24 F–14 squadrons, we would need 442 aircraft. This does not include the interim reconnaissance requirements.

Mr. CROMWELL. Does that include any attrition?

Admiral TURNER. No, there is no attrition in that number.

Mr. CROMWELL. All right, if you could supply the detailed build up for the record to support that, please.

Admiral TURNER. All right, sir.

[The information follows:]

Inventory objective for 24 F–14 squadrons

24 squadrons (12 UE)	288
FRS training	72
Other (director support, R.D.T. & E.)	12
Pipeline	[Deleted]

Mr. CROMWELL. The impression perhaps could have been left from your statement on the high-low mix that it is the Navy's desire to go to the high-low mix.

Admiral TURNER. I think this was a matter of affordability, and the decision was arrived at by the administrations of the past.

Mr. CROMWELL. Would I be wrong in concluding that the fighter Navy would like to go to an all F–14 fighter force?

Admiral TURNER. There are many advantages to be seen from an all F–14 fighter force. However, the importance of the F–18 and A–18 program in its entirety is now a very strong input into the equation. I think that it has been a workable and a reasonable accommodation of both the fleet air defense problem and the strike fighter problems. I think that this is a fairly reasonable arrangement that we now have before us of the 18 F–14 squadrons and the 6 F–18.

F–14 CARRIER OUTFITTINGS

Mr. CROMWELL. This year's procurement, Admiral Alvis, includes support equipment for the 11th aircraft carrier. How many aircraft carriers does the Navy plan to equip with F–14 support equipment?

Admiral ALVIS. We are funded for 12 carriers.

Mr. CROMWELL. Well, you are programed for 12. You are not currently funded for 12, are you?

Admiral ALVIS. Yes, sir. We are currently funded to support 12 carriers.

Mr. CROMWELL. So my impression is that you already have the money in hand to buy the support equipment for 12 aircraft carriers.

Admiral ALVIS. Let me look at the schedule very quickly. Through 1981, which is what I am talking about, to the set-up period, not the funds in hand, we are funded for 12 carriers.

Mr. CROMWELL. In which fiscal year do you receive the funding for the 11th aircraft carrier?

Admiral ALVIS. 1980.

Mr. CROMWELL. I am sorry. I had the impression from earlier discussions that the 11th aircraft carrier support equipment was funded in the fiscal year 1978 budget request.

Admiral ALVIS. I have to be careful what I am talking about in support. I am talking about I level support and spares. In fiscal year

Digitized by Google

1978, in I level support, we are outfitting the 11th carrier. You are right, yes, sir. In fiscal year 1980 we will be buying spares for the 11th carrier.

Mr. CROMWELL. In which fiscal year do you fund to buy the 12th carrier?

Admiral ALVIS. The 12th carrier would be funded in fiscal year 1979. Now, this is for the I level support, which, of course, has a very long lead time.

Mr. CROMWELL. Admiral Turner, why is the Navy equipping 12 carriers if your plan is only to have enough squadrons for 10 carriers?

Admiral TURNER. The F–14's, of course, are designed for fleet air defense and could be on any one of the 12 carriers, depending on rotational cycles, overhauls, and situations. It is thought to be a reasonable course of action to outfit all of the carriers ot accommodate this most important and most numerous fleet air defense fighter.

Mr. CROMWELL. Well, isn't the support equipment mobile, in the sense it can be taken on and taken off any one carrier?

Admiral TURNER. To a certain degree, that is correct, but in other installations—particularly, I am thinking of VAST, that is not. The VAST installation on the carrier has a higher degree of permanency than some of the other I level equipments.

Mr. CROMWELL. I believe the VAST is a permanent installation, isn't it, on the carrier, which applies to any airplane which is set up to have its equipment checked on VAST?

Admiral TURNER. Yes, that is correct.

Mr. CROMWELL. There appears to be some inconsistency in the budget request and the testimony. I see the Navy planned to go up to 20 squadrons, the current plan that you laid out today, but no more. And then, on the other hand, you are equipping carriers for 24 F–14 squadrons.

Admiral TURNER. Yes; well, one of those 12 squadrons could be in overhaul, and 2 squadrons could be employed on another of the 11 remaining carriers and would require that level of maintenance and support on that carrier, even though they were not normally assigned to it. It would be a situation where perhaps the F–18's which were on that 11th carrier, my example, were at a lower state of training, depending on the readiness and mobility requirement.

I think, in summation, it would enhance the flexibility of the total force at the support for this fighter was on all of the carriers.

[The information follows:]

Although our procurement profile for the F–14 shows us building to 20 squadrons from 1982 through 1984, we will be reduced to 18 F–14 squadrons upon introduction of the F–18.

We need 12 F–14 carrier support sites to give us the ability to utilize the F–14 on all twelve *Forrestal*-class and subsequent large multipurpose carriers. This will give us the flexibility to employ our best fleet air superiority fighter on all 12 ships, with at least one F–14 squadron in the hi-low mix which OSD directed, and still be able to equip some of our largest decks with two F–14 squadrons for deployment in the highest threat areas.

Mr. CROMWELL. I had the impression the support equipment was mobile enough to take out a carrier that went in for overhaul and then put onto another one which was going to be deployed.

Digitized by Google

Admiral TURNER. Perhaps Admiral Alvis could indicate where the distinction lies.

Admiral ALVIS. Yes, sir, it is removable; but as you know, it is basically an overhaul installation. It is not readily removable and certainly not with the speed that would be required to react to contingency situations such as Admiral Turner is talking about.

I believe in years past, the explanation we had given is essentially that which Admiral Turner has given just now, that we want the flexibility to put the F-14 on any carrier that might be required for a particular contingency.

POTENTIAL SHORTAGE OF F-14'S IN 1980'S

Mr. CROMWELL. The production rate for the F-14 is increased this year through 1981, under the latest budget program, but then production stops. The Navy "Type B" V/STOL fighter is not indicated as even starting into inventory until 1995 under current planning.

What will the Navy do for fighter aircraft out through the 1980's until 1995?

Admiral TURNER. We have a plan to do a conversion in lieu of further procurement in 1984. At that time, we would begin converting existing F-14's to do just the point that you have mentioned, carry our force levels on out until the introduction of V/STOL Type B. We would also hope that, if we can afford it, we would have available at the same time, to mate up with the converted fuselage-airframe combination, in advanced technology engine.

Mr. CROMWELL. Now, annual attrition is going to cause losses of a certain number of F-14s each year. You indicated earlier that, by 1984 or 1985, your attrition would have brought you down to 18 squadrons.

If you keep the calculated attrition out through 1995, how many F-14's would you have left?

Admiral TURNER. These projections that go out that far, of course, are as close as we can approximate based on our historical information, safety records, accident trends and the like. We are very much encouraged by the far superior safety record of the F-14 at this stage in its development, as compared to either the A-7 or the F-4, in particular.

The airframe-engine combination, overall, is a far better and safer combination than the two I have mentioned. So the attrition we expect, if present trends continue, should be much in our favor, but it is rather early in the life cycle of this aircraft to really know.

I think I would have to, on a year-to-year basis, constantly reevaluate to see how well our planning factors will protect the force levels. There is definitely a problem in the ending of production and carrying across that timeframe to the advent of the V/STOL Type B.

But I think on the total evaluation, it is a reasonable and prudent course of action which will enable us to maintain required force levels in the fighter category.

Mr. CROMWELL. Would you disagree, then, that you are going to be short for your 18 squadrons of F-14's by 1985?

Admiral TURNER. That is a long time in the future. Probably you are right, that there will have to be more F-18's and more F-14's, as the

Digitized by Google

situation continues to run forward. There is also the possibility that V/STOL might be accelerated, thereby reducing the problems from the far end.

Mr. CROMWELL. Let me just summarize by getting to the point of the questions. This subcommittee has had a record, over the years, of looking for stable, long-term planning, rather than upping and then downing production plans. I know there is a lot of criticism of the Pentagon and the Defense Department for its fluctuations in its 5-year plans. It doesn't appear that it makes a lot of common sense to accelerate the procurement of the F–14 line and then shut it off in 1981, when there is no replacement in sight until 1995.

I think that the committee would support a longer term, more stable approach to your fighter problem, your inventory problem.

Admiral TURNER. I am delighted to hear that, because I think that is the way that we are trying to go and would like to see long-term programs that have stability attached to them, as well.

It certainly is our intention. One of the big advantages, of course, of the program which we now have in the 5-year defense plan is the economic advantage of this more rapid buy-out, which is not inconsiderable, saving the taxpayers approximately $2 million per airplane; as opposed to the previous very long-extended low-unit-per-year procurement which had been the prior approach.

So, from an economic standpoint, this present program is certainly a saving of the Nation's assets, but it does bring to the fore the problem which you have pointed out so well.

F–14 OPERATIONAL READINESS

Mr. CROMWELL. Admiral Alvis, you showed your present operational ready rate as about 45 percent. You also said that it was over 80 percent ACEVAL. What is the Navy's projection of what is attainable in the future for the operational readiness rate for the F–14?

Admiral ALVIS. Well, as you know, Mr. Cromwell, this is extremely difficult to project with accuracy. However, I think the experience at ACEVAL–AIMVAL is encouraging, in that with a properly trained crew and with adequate spares, they are maintaining an 80-percent operational ready rate.

Our biggest problem has been the TF–30 engine. We are just now getting into a major modification program on the TF–30 engine and we expect that problem over the next year to diminish considerably. It is not going to be immediate, but we should start to see benefits from that this summer.

Then, I see no reason why, with adequate support, spares, training and stability of personnel, we should not attain our desired goal of operational readiness for the deployed carriers.

Mr. CROMWELL. Your desired goal is what?

Admiral ALVIS. For the deployed carriers, it is 70 percent. The last report that I saw, indicated that the *John F. Kennedy* was experiencing an OR rate of [deleted]. I have not seen the very latest report from *Enterprise* in the Pacific.

Mr. CROMWELL. Are these full-system capable operational ready rates you are talking about?

Digitized by Google

Admiral ALVIN. No, sir. The operational ready rate is slightly above the full-system capability rate. In the case of the F–14, the full-system capability rate is just very slightly below the operational ready rate. In some airplanes, as you know, there is quite a spread, but I am looking at my plot here and they are very close together, only a few percentage points apart.

Mr. CROMWELL. Would you provide the data for the last year for the record.

Admiral ALVIS. Yes, sir.

[The information follows:]

CALENDAR YEAR 1976

	January	February	March	April	May	June	July
Operational ready	26.5	29.7	33.3	31.1	37.9	40.4	37.8
Full system capability	23.8	25.6	27.3	26.9	29.3	32.9	32.6

	August	September	October	November	December	January
Operational ready	42.4	41.0	45.6	44.6	40.6	42.8
Full system capability	32.6	29.0	40.3	40.5	36.0	36.2

Admiral ALVIS. What I was referring to is right here. Our operational readiness is here. Our full-system capability is here. They track very closely together in the case of the F–14.

Mr. CROMWELL. Has the Navy, or have you, been tasked to make a projection into the future?

Admiral ALVIS. Yes, sir. We have done this two ways. First, we developed a sensitivity model to determine what would be the increase in operational readiness due to each of the myriad of things that you could change.

We have looked at it from that point of view and, as far as what I control in the airplane, I could never get there just with reliability improvements. There have to be additional supply improvements in order to get us where we want to go.

We see that very clearly in our sensitivity model. For example, I can increase the reliability 100 percent in many of the key elements in the airplane, and the operational readiness will only go up a very small fraction, maybe 2 percent.

So you have to look somewhere else, and the somewhere else we are looking is in the supply and in the maintainability area.

The other way we have looked at this, was to not look at this very complex model but just look at the 3M data in the past, take that data and go back and look at it and say, all right, I am fixing the engine problems. I have fixed half of them. Now, what would that data look like?

Or if I make a major change to the vertical display in the airplane, what effect would that have? We extracted those failures to see what effect that would have.

Again, we get only up to a ceiling of somewhere around 60 percent with what we can do to the airplane and then you have to look more into supply and maintainability areas.

Digitized by Google

Mr. CROMWELL. So you will have to be buying more spares to get it up to 70 percent?

Admiral ALVIS. Yes, sir. But the kinds of spares I am really talking about now are fairly small-dollar-type spares. The large, expensive rotable pool items, we essentially have bought, but as we gain experience in repairing this equipment, we find we need all the many bits and pieces. This is not a big-dollar cost but it is many, many things and it takes a lot of experience to get all of these off the shelf.

Mr. CROMWELL. Would you supply an estimate for the record of how much your additional cost will be in millions in the spares area, to bring that operational ready rate up to 70 percent.

Admiral ALVIS. Yes.

[The information follows:]

The hardware and funding requirements to improve the F-14 Operational Readiness to the CNO standard of 70 percent have been identified.

In May 1976 the CNO directed an Operational Readiness Improvement Program review to identify both short and long term initiatives to be taken to improve Operational Readines of the F-14. Increased rotable pool levels were identified to support actual I level turn around time for repairables, and increased bond room spares were identified to improve turn around time for depot level repairs. The funding to increase the level of spares at the Intermediate and Depot level repair sites is 26.8M and has been identified as part of the $66.9M reprogramming action currently before Congress.

Upon release of these funds by the Congress, spares will be placed on order, however, approximately 2 years lead time is required before this increased level of spares begin to appreciably impact F-14 Operational Readiness.

In addition to the funds identified above, fiscal year 1978 O. & M.N. funding in the amount of $2.7M is required to provide adequate shelf stock to support operating site allowances.

It should be noted that the short range initiatives identified in May 1976 have contributed to improving Operational Readiness from 26.5 percent in January 1976 to just under 50 percent in February 1977.

Mr. CROMWELL. What are your maintenance man-hours running?

Admiral ALVIS. Across the board, around 45 maintenance man-hours per flight hour. I am sorry I don't have it with me, but the Pacific Fleet just sent in a report in the last week, comparing, I think—here is the information.

Admiral TURNER. I have the figures. Direct maintenance man-hours per flight hours reported by Commander, Naval Air Force, Pacific Fleet. He points out the considerable improvement in the later block 90 aircraft, where the direct maintenance man-hours per flight hour are at an alltime low of 31, as opposed to block 85, prior aircraft, of 46 and the older aircraft, which have been the big problem all along, of 66.

So it essentially cut the maintenance man-hours per flight hour in half, due to the more reliable, later, completely modern block 90 aircraft.

PHOENIX MISSILE IN FLEET AIR DEFENSE

Mr. CROMWELL. In yesterday's hearing, the surface Navy stated that the latest studies of Navy fleet air defense, which they call the NNOR calculations, for air defense missiles showed that a Phoenix missile would account for only 5 percent of the kills of enemy aircraft and cruise missiles and the shipboard SAM's would kill 95 percent.

Why is the Phoenix kill rate so low?

Digitized by Google

Admiral TURNER. I think I would have to provide an analysis of whatever this report is for the record. Our experience is quite the contrary and almost the reverse percentages.

Mr. CROMWELL. Do you have an air-to-surface war going on here within the Navy?

[The information follows:]

I believe the documentation referred to is the NNOR, Non-Nuclear Ordinance Requirements. In Volume III, Threat-Oriented Ordnance, the total number of targets presented is utilized to assess the allocation of the Threat to the Kill System. While only [deleted] of the total missiles are allocated to Phoenix, [deleted] of the bombers are credited to Phoenix kills, [deleted]. The Phoenix with its area of coverage many times greater has comparable kill rates as other AAW Systems.

TF–30 ENGINE STATUS

Mr. CROMWELL. What is the status of the TF–30 engine program, the program to fix the TF–30?

Admiral ALVIS. As you know, we were before the Congress in September of this year to get funds to go into a modification program for the TF–30 engine. We rquested the reprograming of some $24.5 million to get a start along that line.

Today, we have completed the tests that we wanted to run at that time. We have tested the first stage fan blades in a spin test and we think we have a very reliable first stage fan blade, which was one of the major sources of our problem.

In the third stage of the engine, we had a disc, or a disc blade combination that was giving us a resonance problem, which led to a catastrophic failure of the engine. We have, by some modifications to the existing engine which we are very carefully, essentially solved that problem. At least, it appears that we have, right now.

We are watching it very carefully.

But then, on top of that, to make sure that when we have fan blade failures, we don't have catastrophic loss of the airplane, we have put containment around the first three stages of the engine. We have tested this engine in the test cell at Pratt-Whitney, and we have run the engine over speed and then failed massive numbers of blades. In the movies, it is a very traumatic failure, but everything was contained within the engine. That was our objective with the containment so that we wouldn't have these large blades flying out into the airplane, causing the fires that we have had in the past.

These tests were very successful. We have flown the modified engine in the test cell for a simulated 1,000-hour mission endurance test. We have flown this engine at altitudes for inlet distortion tests, and we have confirmed with limited flight tests our flight envelop for the F–14, just to make sure there were not any anomalies.

With that assurance, in January, we went into production with the modified engines. Those modified engines started coming off the production line in January and this month, in March, we are starting to modify the previous P–412 engines. They will become P–414 engines, which will mean they have the new first-stage blade and the containment.

I think we are going to have a very rugged TF–30 engine.

Digitized by Google

COST TO FIX F–14 ENGINE

Mr. CROMWELL. How much is it going to cost to fix all those engines?

Admiral ALVIS. About $94 million.

F–14 STRUCTURAL STATUS

Mr. CROMWELL. What is the SDLM repair program? Would you describe that?

Admiral ALVIS. Yes, sir. Our standard depot level maintenance is our regular depot rework of our airplanes. The F–14s, initially, the first few lots of airplanes were scheduled for standard depot-level maintenance at 24-month intervals. That is, 24 months from the time they were accepted from production they would be due for depot rework.

After the first few lots, we have gone to a 30-month interval for them to go into depot rework and of course, we expect as the airplane matures, to increase that period.

As these early airplanes go back into the standard depot-level maintenance, we are correcting deficiencies in the airplane, that we have already corrected in the other production airplanes, to bring those early-production airplanes up to the standard to which Admiral Turner was just referring. The fleet is very pleased with these airplanes and is experiencing very good reliability with them.

Mr. CROMWELL. What kind of deficiencies are you talking about?

Admiral ALVIS. We have several time compliance items that have to be repaired. Probably the most serious is a 569 bulkhead problem. We discovered in the fatigue tests on the airplane that the bulkhead was good for roughly 1,500 hours without some modification being done to it.

As the airplanes are coming into the standard depot-level maintenance now, we are reworking that bulkhead to take it out to the full 6,000-hour life of the airplane.

There are numerous other, smaller, structural changes, primarily associated with the catapaulting gear and the arresting gear. Those are being changed out at the same time during the standard depot-level maintenance. That is a very important part of the standard depot-level maintenance, but I think a very encouraging part of the standard depot-level maintenance is that, by bringing the early airplanes up to a later configuration, which we are able to do, we have a much more reliable airplane than we were producing 3 years ago.

Mr. CROMWELL. Well, in summary, the SDLM program is a program to fix the major fatigue problems which were discovered on the earlier F–14. Isn't that correct?

Admiral ALVIS. If we had had no fatigue problems at all, we would still have had to induct these airplanes for the standard depot-level maintenance. Certainly, a large part of the work, a large number of man-hours now, during the standard depot-level maintenance, is associated with correcting those problems.

This is not terribly unusual. I would say, in the early stages of a major aircraft program. We now have over 100,000 hours in the vicinity of 100,000 hours flight time on the F–14, so I think we have found most of our problems.

38-379 O - 77 - 34

Digitized by Google

COST TO FIX F–14 STRUCTURE

Mr. CROMWELL. How much is it going to cost to fix those early fatigue problems?

Admiral ALVIS. I would have to supply that for the record. I don't have that. It is lumped in with the total funding for the standard depot-level maintenance. Some parts of it, the contractor is required to fix, some parts he is required to provide the kits for fixes, and some of those that are completely out of warranty, we are required to fix the whole thing.

So it is a mix. I will have to add up the whole thing and give you an answer, and I will.

Mr. CROMWELL. I have a figure of $156.4 million. Does that sound all right?

Admiral ALVIS. That sounds awfully high.

[The information follows:]

Total cost to fix early aircraft fatigue problems is $12.6 million. One hundred and thirty-five time-compliance requirements are being incorporated into 82 F–14 aircraft.

F–14 SURVIVABILITY FIXES

Mr. CROMWELL. What is being done to improve the susceptibility to fire?

Admiral ALVIS. That is the second part of our reliability/survivability improvement program. The first part is the engine that I was just speaking of. The fire survivability portion puts in a fire extinguishing system which discharges a fire extinguisher into one of the engine cells if you should have a fire and discharges a second fire extinguisher up into the trough of the airplane.

This will knock down any immediate fire that crops up. Then, to keep the fire from propagating throughout the airplane, which has been our major problem in the past, we have installed baffles in certain parts of the airplane to stop these air paths. That stops the flame from propagating and it also protects the control linkages of the airplane.

Then, a few minor things that we have done in connection with this are to put an ablative material on certain bell cranks back in the tail of the airplane. As they get hot, the ablative material will flake off and the bell cranks will not become pliable, as we have seen happen in some of our other accidents. In addition, we are putting a titanium sheet over certain parts of the engine nacelle to further contain the fire within the engine itself.

We took one of the early test airplanes to the Naval Weapons Station in China Lake and turned it up with an engine running and with a rig that had been built during the Vietnamese war to improve survivability of the F–4. We blew air over the airplane as though it were in flight, failed the engine with an explosive charge, let the fuel run, and found that our fire extinguishing system worked very well.

As a matter of fact, the fire extinguishing system blew the fire out of the airplane so quickly that it didn't really test the ablating material and the other things. Then we had to go back and build individual fires around the airplane to test this part of the survivability program, and it looked very good.

Digitized by Google

I think by this method we have built an airplane that in combat is going to be a very rugged airplane.

COST TO FIX F–14 FIRE SUSCEPTIBILITY

Mr. CROMWELL. What is the total cost of the fire improvement program?

Admiral ALVIS. The engine and the fire survivability equipment of the airplane together are about $206 million. I told you the engine was about 94 so the rest of the airplane must be about 112.

F–14 CONCURRENCY

Mr. CROMWELL. How many airplanes were built before block 90? Was block 90 the one where you add all the improvements in?

Admiral ALVIS. Yes, sir.

Block 90, are the fiscal year 1976 airplanes, and we had 184 airplanes before that block.

Mr. CROMWELL. Is it fair to say that the reason you had all these problems in the early points is because of the crash program for the development of the F–14 and the amount of currency?

Admiral ALVIS. I would be getting into speculation, and I hesitate to do that, but as we looked at these other development programs this morning, I couldn't help comparing them with the F–14.

From the initial signing of the contracts until the first flight was slightly less than 2 years, and that certainly is much more concurrent and much more rapid than the kind of program you see today.

Mr. CROMWELL. The first production airplane came along in about 4 years?

Admiral ALVIS. The first production plane came, and the decision was made about the time the first airplane flew.

STATUS OF F–14 RADAR

Mr. CROMWELL. What deficiencies have been found with the radar in the AIMVAL–ACEVAL tests at Nellis, and how much is it going to cost to fix that problem?

Admiral ALVIS. Instead of talking about the deficiencies in that very restricted scenario at Nellis, I prefer to think of them as limitations on the basic state of the art at the time the AWG–9 was built. The AWG–9 was optimized for long-range search for the Phoenix missile, long-range observation, and was not optimized for the very restricted scenario that, of course, we see in the ACEVAL–AIMVAL.

It was not optimized for overland operation. It was optimized for ocean-type operations and, again, for long-range use.

There are some things which we could do to improve the operation in that very restricted scenario, and we are looking at those. I don't have a good price as to what it would be to make these improvements, and I would caution that we ought to be very careful and not jump to any conclusions that would in any way compromise our long-range Phoenix capability in order to improve our performance in this very restricted ACEVAL–AIMVAL scenario.

Digitized by Google

PHOENIX IMPROVEMENT PLAN

Mr. CROMWELL. Would you describe the Phoenix improvement program, tell us how long that development will take and how much it is going to cost for R. & D.? You could do that for the record.

Admiral ALVIS. Yes, sir.

[The information follows:]

The Phoenix Improvement Program is an upgrade of four selected missile units of the current AIM-54A missile. These four units are the Target Detecting Device, electronics units, receiver-transmitter unit and autopilot.

The Target Detecting Device is being redesigned by the Naval Weapons Center, China Lake, Calif., and will incorporate a pseudo noise feature. The improved target detecting device will improve kill probability over a wider threat spectrum; improve capability in rain; and enhance capability in an ECCM environment. Reliability will also be improved.

The improved electronics unit will be digital and will incorporate the autopilot function, increasing capability against ECM and very high altitude, very fast targets. The unit will be reprogrammable and possess growth capability. The autopilot will include an inertial reference.

The improved receiver-transmitter unit will be solid state and will incorporate linear frequency modulation to expand capability against opening targets, cluster targets and beam aspect situations.

The improved electronic unit (including autopilot) and the improved receiver-transmitter will also improve reliability.

Engineering development is planned for completion by December 1980. R.D.T. & E. cost for the Phoenix Improvement Program is currently estimated at $81.9M.

Mr. CROMWELL. It is over $80 million in R. & D., isn't it?

Admiral ALVIS. Yes, sir. It is about $86 million, if I remember correctly.

Mr. CROMWELL. Also, would you tell us how much the improved Phoenix production program would cost? Give us that for the record.

Admiral ALVIS. Yes, sir.

[The information follows:]

AIM-54C PROCUREMENT PROFILE

[Dollar amounts in millions]

	Fiscal year—			
	1980	1981	1982	Tota
Quantity	60	165	240	465
Weapon system cost	$38.2	$74.0	$108.9	$221.1
Unit cost	$0.637	$0.448	$0.454	$0.475

STATUS OF F-14 TIDS

Mr. CROMWELL. What is the F-14 target identification system, or TIDS, and how much would it cost to develop that?

Admiral ALVIS. We are just getting started on that program, which is a programable signal processor. It replaces our current analog system with an additional system which will allow us to process signals much more rapidly. This, in addition to giving us target identification, would improve many of the problems that we see in ACEVAL-AIMVAL.

One of the criticisms of the F-14 Phoenix weapon system from the very beginning has been the fact that we could shoot [deleted]. With this target identification device, we have demonstrated the capability

Digitized by Google

in the laboratory to, by the return signal from a target airplane, that it is capable of identifying the target [deleted].

That would give us a tremendous advantage in the fight scenario in the Mediterranean, where the airplanes are very congested.

We are so early in this program—we are only funded for an engineering development model—that I couldn't really give you a good total cost estimate.

Mr. CROMWELL. We are talking way over $25 million, aren't we?

Admiral ALVIS. Yes, sir.

Mr. CROMWELL. $100 million?

Admiral ALVIS. It would be just a guess, but it is going to be very expensive to change the whole processor in the airplane.

Mr. CROMWELL. Do you have any estimate what it would cost to retrofit that system on all of the F–14's?

Admiral ALVIS. When I was talking about $100 million just now, I was thinking of retrofit. It would be far less than that for the R. & D. development. There are other programs working on similar signal processors right now.

By all of us working together, I think we can get this for a fairly reasonable R. & D. price.

Mr. CROMWELL. Could you give an estimate, a ballpark estimate?

Admiral ALVIS. I really can't because, as I say, we are only funded through an engineering development model and that, I remember correctly, is about $10 million, which may be a bit on the high side.

STATUS OF F–14 ENGINE

Mr. CROMWELL. How much will the F–14B engine cost to develop?

Admiral ALVIS. I believe the estimate Admiral Turner gave this morning is as good as we can come up with at this time. I would estimate somewhere in the vicinity of $350 million, and then to retrofit the F–14 fleet, somewhere in the vicinity of $1.7 or $1.8 billion.

Mr. CROMWELL. How much does the retrofit cost?

Admiral ALVIS. Somewhere in the vicinity of $1.7 to $1.8 billion to retrofit the whole 521 airplanes.

Mr. CROMWELL. I had a figure earlier from the Navy of $2.8 billion in fiscal year 1976 dollars to retrofit the engines. If you could supply the answer.

Admiral ALVIS. Yes, sir.

Mr. CROMWELL. But I would also like to know if you escalated those dollars into any representative mid-80's timeframe. Give us an estimate of what that would cost.

Admiral ALVIS. Yes, sir.

[The information follows:]

The current estimate, in then-year dollars, to retrofit an advanced engine into 521 aircraft is $2.8 billion.

F–14 FUNDING PROBLEMS

Mr. CROMWELL. In summary, while the cost to buy out of the 1978 to 1981 F–14 program was indicated today as being $4.2 billion for 206 airplanes, that cost does not include the additional cost of fixing your present engine, fixing your present airframe structural problems, de-

Digitized by Google

veloping and buying the target identification system, developing and buying the improved Phoenix, developing and retrofitting the F–14B engine.

Admiral Turner, this F–14 program looks like it is going to be quite a drain on naval aviation as we go along in the next 5 to 10 years. Is this causing you any funding problems, your naval aviation plans?

Admiral TURNER. The F–14, as you have indicated, is an expensive aircraft which has an extraordinary capability. The problem we face is determination of the tradeoff and the balance between the procurement cost, the maintenance cost, and the capabilities.

I have to say, in defense of the aircraft, that reports we are getting from the fleet show material readiness up [deleted] on the *John F. Kennedy*, in the high [deleted] on the *Enterprise* deployed squadrons now. That is on the order of magnitude of twice what it was on the prior deployments.

The latest model aircraft are coming off the production line and are being utilized with less maintenance, fewer cannibalization actions—far fewer than ever before.

They are telling us that the aircraft has matured, it has arrived, and that the capability of the Phoenix missile system, the F–14, in conjunction with the E–2C, offers the capability for fleet air superiority and fleet air defense that is satisfied nowhere else in no other way.

This aircraft can reach out at great distances, in conjunction with the E–2C or other radars and then operate and launch its missile which, our experience shows, has a very high degree of success. It is the only combination we have against most of the known really serious threats that repose in such things as the [deleted] and the missiles that they carry.

So therein lies the basic equation. It is causing us funding problems because of the magnitude of the program and therefore, we have been forced to adjust a high-low mix, as we have discussed a little earlier, of mostly F–14's and also some F–18's.

But I think the balance that has been achieved is a reasonable one.

This is a long answer to your question which is, yes, it is causing funding considerations and problems, but with regard to the capability that the aircraft has, I see no other answer to it.

Mr. CROMWELL. Well, I am just wondering what the rationale is and if it is a valid rationale, accelerating this program to buy it out early as has been discussed today. What we are talking about is buying an attrition buy, by 1981. What is the rationale particularly if you have these funding problems, when we consider the fact that—I don't think the committee denies the fact that it is an excellent airplane and that the Navy must have it, but the committee wants to look at the question of what are you going to do between now and 1995. What are you going to do between 1981 and 1985?

It might appear that an accelerated buy-out is not the long-term solution to the Navy's fighter problem. We will have to consider these factors and discuss them some more.

Can we go into a quick summary on the V/STOL and some questions?

Admiral TURNER. Surely.

Digitized by Google

We have a short presentation by Captain Dunleavy on the Navy's current V/STOL program, its genesis, and its projections.

Mr. CROMWELL. Captain, we will put your whole statement in the record, if you could just highlight it now and give us the flavor of it. Then we will get right into the questions.

NAVY V/STOL PROGRAM REVIEW

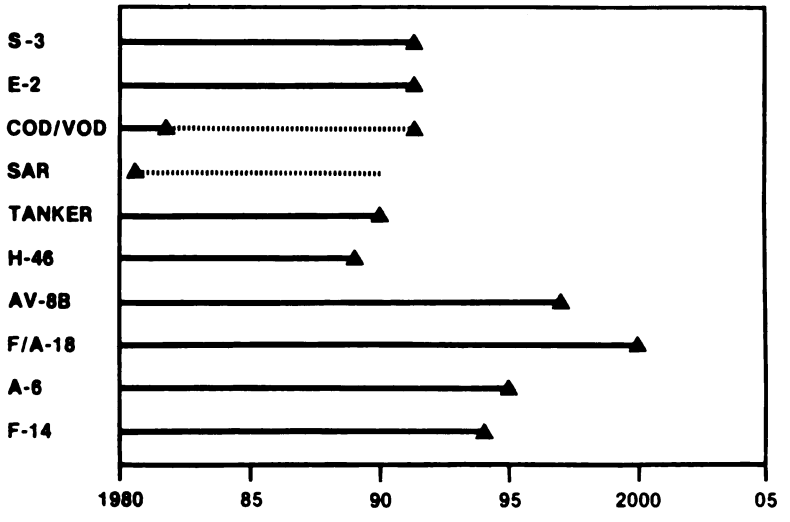
Captain DUNLEAVY. Sir, previous speakers have addressed current operations, the increasing Soviet threat, and the Navy's plan for aviation procurement. Now, I would like to look forward 14 years to the year 1991, the approximate year of V/STOL fleet introduction.

In order to meet the future threat, we are investigating various methods to confound the enemy. Diversity of forces is the predominant advantage of V/STOL. The ability to widely disperse our force, yet maintain task force integrity, geometrically complicates our adversary's problem. His questions: What target is the high value unit? Where is the command center? What are the defenses? Where is the offensive punch?

These three questions are the standards that the V/STOL program must continually address. Can V/STOL satisfy the Navy's needs? Is the concept feasible? What is the life cycle cost?

NAVAL AVIATION PLAN

APPROXIMATE IOCs FOR REPLACEMENT AIRCRAFT



Reviewing our current inventory of aircraft, we do not have a requirement for a follow-on new design aircraft until the early 1990's when aircraft such as the S–3, E–2 and the CH–46 begin to retire. Other aircraft, such as the F–14 and the A–6 will not begin to retire until the mid–1990's.

Now, behind the bulwark of 12 aircraft carriers and no follow-on new design aircraft requirement imminent, we have the time to conduct at a deliberate pace an in-depth investigation of V/STOL.

Digitized by Google

In striving to achieve one of the major goals of naval aviation, namely, the reduction in the number of types of aircraft that we support, follow-on aircraft will be designed for multimission application where feasible. In following this objective, we envision the possibility of two basic types of V/STOL aircraft to satisfy many of our missions.

The first grouping, called Type A for convenience, will include subsonic multimission aircraft. A second grouping, Type B V/STOL, will be a high performance multimission aircraft.

In line with our naval aviation objectives of reduced types, multimission designs are a part of our future planning, regardless of whether V/STOL or conventional. If we were developing a conventional aircraft, our aim would still be for a common aircraft to perform the ASW, AEW, COD and Tanker missions. Therefore, the majority of our planned V/STOL design and technology work provides a parallel development path for a conventional aircraft, should we not proceed with V/STOL.

VSTOL SUPPORTING TECHNOLOGY

AVIONICS

- ADV AEW RADAR
- COMPRESS
- AVIOPTICS
- ADV INTEGRATED DISPLAY SYSTEM
- NAVTOLAND
- MODULAR AVIONICS PKG
- INTEGRATED INERTIAL SENSOR A'SSY
- TACTICAL INFO EXCHANGE SYSTEMS
- MULTI-SENSOR PROCESSOR
- INFORMATION HANDLING SYSTEM
- DIGITAL FLY-BY-WIRE

AIRFRAME

- ADV ACFT ELECTRICAL SYSTEM
- SELF START SYSTEM
- LT WT ENVIRONMENTAL CONTROL
- MAX PERFORMANCE EJECT SEAT
- LT WT HYDRAULICS
- COMPOSITE STRUCTURES

PROPULSION

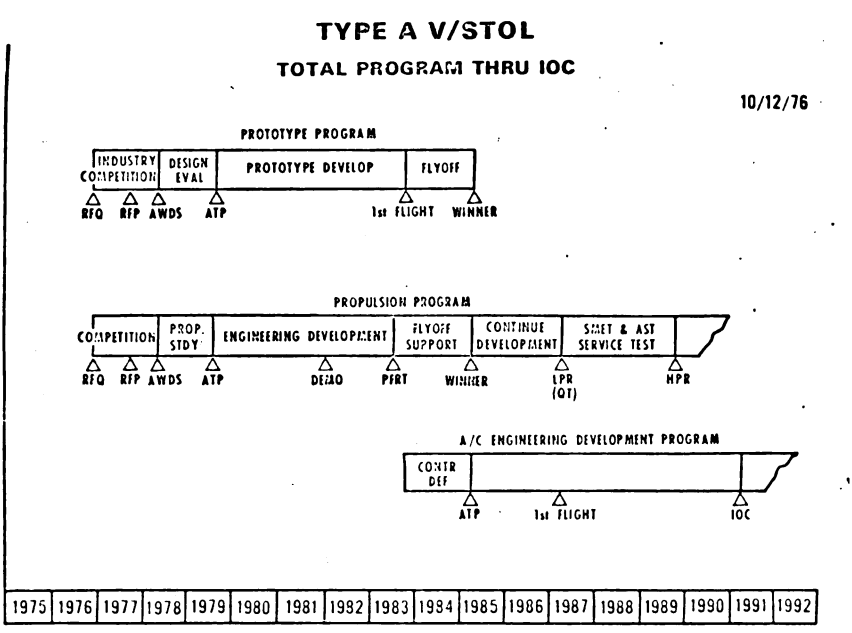
- ENGINE DRIVE SYSTEM COMPONENTS
- FAN CHARACTERISTICS
- ENGINE TEST FACILITY MOD
- THRUST VECTORING DEVICES

This chart displays some of the technologies that are integrated to the V/STOL program because of their criticality to V/STOL but that have application to a conventional aircraft. All of the avionics technologies, such as the AEW radar, are directly applicable. All of the airframe items such as the composite materials and lightweight systems have direct application. The basic propulsion technologies could have application.

Digitized by Google

TYPE A V/STOL

TOTAL PROGRAM THRU IOC



A phased development program for the type A V/STOL program is planned. During the concept formulation phase, industry will be solicited for design concepts of operational V/STOL weapon systems.

Following an assessment of the information received in response to this unfunded solicitation, a request for proposals will be issued to industry in late 1977.

Based upon evaluation of these responses, several contracts for aircraft, engine and avionics conceptual studies will be awarded. These studies will define operational type A weapon systems, establish realistic performance and cost goals, identify major areas of risk and formulate detailed total development plans.

During the validation phase, design, fabrication, test and evaluation of competitive prototypes, including engines and hardware demonstration of critical avionics technology will be conducted. Full scale engineering development and follow-on production will lead to an IOC in 1991.

Digitized by Google

Admiral TURNER. I think I would have to provide an analysis of whatever this report is for the record. Our experience is quite the contrary and almost the reverse percentages.

Mr. CROMWELL. Do you have an air-to-surface war going on here within the Navy?

[The information follows:]

I believe the documentation referred to is the NNOR, Non-Nuclear Ordinance Requirements. In Volume III, Threat-Oriented Ordnance, the total number of targets presented is utilized to assess the allocation of the Threat to the Kill System. While only [deleted] of the total missiles are allocated to Phoenix, [deleted] of the bombers are credited to Phoenix kills, [deleted]. The Phoenix with its area of coverage many times greater has comparable kill rates as other AAW Systems.

TF-30 ENGINE STATUS

Mr. CROMWELL. What is the status of the TF-30 engine program, the program to fix the TF-30?

Admiral ALVIS. As you know, we were before the Congress in September of this year to get funds to go into a modification program for the TF-30 engine. We rquested the reprograming of some $24.5 million to get a start along that line.

Today, we have completed the tests that we wanted to run at that time. We have tested the first stage fan blades in a spin test and we think we have a very reliable first stage fan blade, which was one of the major sources of our problem.

In the third stage of the engine, we had a disc, or a disc blade combination that was giving us a resonance problem, which led to a catastrophic failure of the engine. We have, by some modifications to the existing engine which we are very carefully, essentially solved that problem. At least, it appears that we have, right now.

We are watching it very carefully.

But then, on top of that, to make sure that when we have fan blade failures, we don't have catastrophic loss of the airplane, we have put containment around the first three stages of the engine. We have tested this engine in the test cell at Pratt-Whitney, and we have run the engine over speed and then failed massive numbers of blades. In the movies, it is a very traumatic failure, but everything was contained within the engine. That was our objective with the containment so that we wouldn't have these large blades flying out into the airplane, causing the fires that we have had in the past.

These tests were very successful. We have flown the modified engine in the test cell for a simulated 1,000-hour mission endurance test. We have flown this engine at altitudes for inlet distortion tests, and we have confirmed with limited flight tests our flight envelop for the F-14, just to make sure there were not any anomalies.

With that assurance, in January, we went into production with the modified engines. Those modified engines started coming off the production line in January and this month, in March, we are starting to modify the previous P-412 engines. They will become P-414 engines, which will mean they have the new first-stage blade and the containment.

I think we are going to have a very rugged TF-30 engine.

Digitized by Google

COST TO FIX F–14 ENGINE

Mr. CROMWELL. How much is it going to cost to fix all those engines?
Admiral ALVIS. About $94 million.

F–14 STRUCTURAL STATUS

Mr. CROMWELL. What is the SDLM repair program? Would you describe that?

Admiral ALVIS. Yes, sir. Our standard depot level maintenance is our regular depot rework of our airplanes. The F–14s, initially, the first few lots of airplanes were scheduled for standard depot-level maintenance at 24-month intervals. That is, 24 months from the time they were accepted from production they would be due for depot rework.

After the first few lots, we have gone to a 30-month interval for them to go into depot rework and of course, we expect as the airplane matures, to increase that period.

As these early airplanes go back into the standard depot-level maintenance, we are correcting deficiencies in the airplane, that we have already corrected in the other production airplanes, to bring those early-production airplanes up to the standard to which Admiral Turner was just referring. The fleet is very pleased with these airplanes and is experiencing very good reliability with them.

Mr. CROMWELL. What kind of deficiencies are you talking about?

Admiral ALVIS. We have several time compliance items that have to be repaired. Probably the most serious is a 569 bulkhead problem. We discovered in the fatigue tests on the airplane that the bulkhead was good for roughly 1,500 hours without some modification being done to it.

As the airplanes are coming into the standard depot-level maintenance now, we are reworking that bulkhead to take it out to the full 6,000-hour life of the airplane.

There are numerous other, smaller, structural changes, primarily associated with the catapaulting gear and the arresting gear. Those are being changed out at the same time during the standard depot-level maintenance. That is a very important part of the standard depot-level maintenance, but I think a very encouraging part of the standard depot-level maintenance is that, by bringing the early airplanes up to a later configuration, which we are able to do, we have a much more reliable airplane than we were producing 3 years ago.

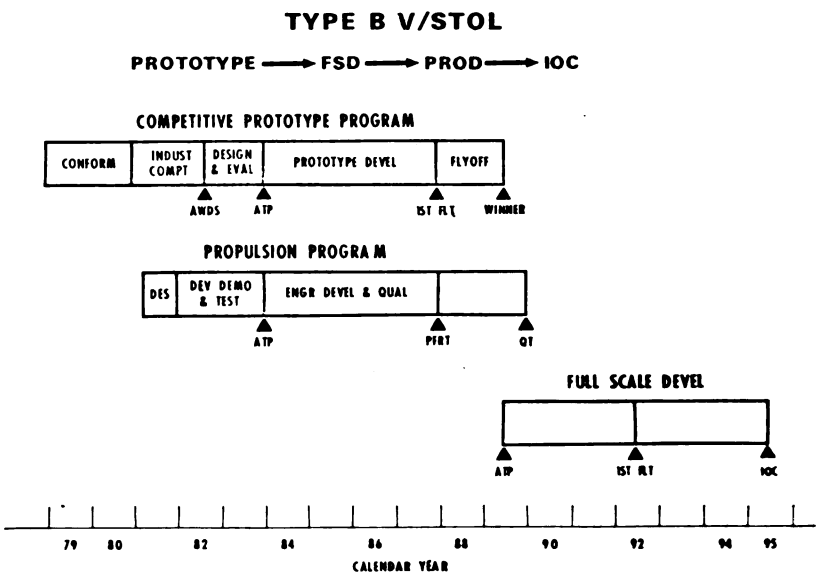
Mr. CROMWELL. Well, in summary, the SDLM program is a program to fix the major fatigue problems which were discovered on the earlier F–14. Isn't that correct?

Admiral ALVIS. If we had had no fatigue problems at all, we would still have had to induct these airplanes for the standard depot-level maintenance. Certainly, a large part of the work, a large number of man-hours now, during the standard depot-level maintenance, is associated with correcting those problems.

This is not terribly unusual. I would say, in the early stages of a major aircraft program. We now have over 100,000 hours in the vicinity of 100,000 hours flight time on the F–14, so I think we have found most of our problems.

88-357 O - 77 - 34

Digitized by Google



This is indeed a long but thorough program.

Operational concept studies for type B V/STOL have just commenced. It is envisioned that a program similar to type A's will be initiated in about 1980, for an IOC of 1995.

V/STOL R&D FUNDING JANUARY 1977
($M/THEN YEAR)

TITLE	FY-78	FY-79	FY-80	FY-81	FY-82
ADV V/STOL TYPE "A"	28.2	56.7	106.7	203.3	421.7
V/STOL SUPERSONIC "B"	-	-	4.8	4.8	26.3
V/STOL SUPPORT TECHNOLOGIES	8.3	33.1	34.9	35.6	42.3

*FY-78/79 Funds expended prior to prototype ATP in July 1979 is $62.1M
(41.3 V/STOL A)

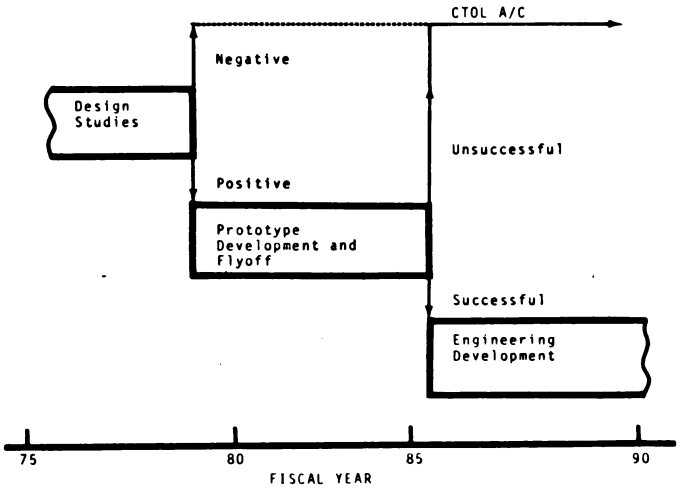
The current R. & D. V/STOL funding as displayed here is dedicated to the subsonic and supersonic aircraft and their supporting technologies. Unlike other programs, the program manager, Captain Dapogny, is responsible for both the aircraft R. & D. line and the supporting technologies in order to maintain program integrity and prevent redundancy of effort.

I call attention to the footnote here. Prior to the authority to proceed with the prototype, the Navy will have expended $62.1 million. As previously stated, all the critical technologies have been incorporated under the V/STOL program manager. As such, some previously funded technologies for other aircraft programs were absorbed. This amounts to about $20 million of the $62.1. So the net V/STOL A expenditure will be $41.1 million.

In concludng, is the Navy committed to an irreversible path? The answer is a definite no.

Digitized by Google

VSTOL DECISION POINTS



Our system of continual program checks is in line with the key decision points of V/STOL. We have structured a program with alternate courses of action.

This chart depicts two type A decision points, their relationship to naval aviation planning, and alternative courses of action.

If the initial V/STOL conceptual design studies indicate that V/STOL could not satisfy our requirements, then no design effort would be required until it was time in the 1980's to establish plans for a follow-on conventional aircraft required in the early 1990's. If, as expected, the design studies are positive, then we will continue with the development plan.

The competitive prototype flyoff will be completed in 1985, which is another major milestone decision point. If the prototype flyoff is successful, the program would continue into a normal engineering development. If the flyoff failed to provide convincing evidence to proceed with V/STOL, the program would be redirected toward a conventional multimission aircraft to fulfill the same tasks.

Since a prototype flyoff would not be warranted due to the relatively low-development risk of a conventional aircraft, it could have an IOC in the early 1990's. The point is, we have this period of time between now and 1985 to thoroughly investigate V/STOL through a prototype flyoff without jeopardizing our required replacements for carrier-based air in the 1990's.

This has led the Navy to the conclusion that the time is right to pursue V/STOL.

That concludes a 5-minute summary of a 12-minute synopsis of a 20-minute speech. [General laughter.]

[The prepared statement follows:]

PREPARED STATEMENT OF CAPT. DICK DUNLEAVY

Good morning. I am Captain Dick Dunleavy, the V/STOL program coordinator within the Office of the Deputy Chief of Naval Operations (air warfare).

Digitized by Google

In the next few minutes we will explain why the Navy is conducting an in-depth investigation of V/STOL, what we have done so far and how we plan to manage this evolution.

The three questions that are the standards that the V/STOL program must continually address are: Can V/STOL satisfy the Navy's needs? Is the concept feasible? What is the life cycle cost?

First we'll define V/STOL. V/STOL, is vertical and short takeoff and landing. The aircraft we will discuss can take off and land vertically. However, to increase payload, namely fuel or ordnance, they can use a short take-off roll usually several hundred feet or less, but still land in a vertical mode.

As stated by the Congress in Title 10, U.S. Code, the mission of the Navy is to conduct prompt and sustained combat operations at sea. Over the past decade, with reduced reliance on overseas bases, extended surveillance capability, long-range striking power and tactical flexibility have been provided to the U.S. fleet by sea-based air power. These capabilities have been indispensable in the past and are likely to remain so in the future, especially in crisis management. In support of this basic U.S. requirement, certain factors are relevant to establishing the needs for future aircraft developments:

(A) To maintain the required sea-based air capability on board the existing force or large deck carriers, as well as the required marine amphibious assault capability, current navy and marine aircraft will require replacement in the future because of aging and obsolescence.

(B) In view of the projected future capabilities of the Soviet forces, U.S. Naval sea based aircraft capabilities, together with the other elements of the naval force, must be improved to defeat the rapidly advancing Soviet threat.

(C) With the increased Soviet open ocean deployments of modern ships and submarines and the longer range of land based naval bombers, there is an increased demand on U.S. military forces to be responsive over more ocean areas than before. This translates into more naval forces with the capability to defeat the Soviet Navy. With the versatility that manned aircraft add to a naval force, there is a need for more ships to be air capable: ships that range in size from the aircraft carrier to small ships where manned aircraft are used primarily as an extension of the ship's own weapons by expanding its horizons for targeting and identification. This, coupled with the increased Soviet capacity for command/control and targeting, requires a dispersal of sea-based aircraft among more platforms to enhance force flexibility and survivability. Survivability, as well as flexibility is greatly enhanced by the ability to disperse air-capable forces by: (1) compounding the enemy's surveillance and targeting problem; (2) creating multiple targets even when the force is concentrated; and (3) by being able to selectively apply air power in a war or by being able to tailor forces to sufficiency in a limited confrontation without having to apply an overwhelming but numerically limited force.

The exploitation of vertical and short takeoff and landing (V/STOL) technology is a means of satisfying these needs. It appears that V/STOL technology can provide a very capable replacement for carrier-based aircraft as they approach the end of their service life, while offering flexibility in further carrier designs, in both size and configuration, and offers great promise in future fleet employment options and an overall increase in total fleet effectiveness. The potential improvement in marine assault operations is also significant. V/STOL can improve the performance of aircraft operating from non-carrier platforms and hopefully permit the utilization of high performance tactical air from hitherto non-aviation-capable platforms. Technological advances now in progress in the critical areas of propulsion, airframe, and avionics appear to provide an opportunity to develop a variety of V/STOL aircraft with multimission application. This envolves from making items lighter and smaller--which allows the overall airframe to be reduced in size and weight--and the attainability of higher thrust levels and lower fuel consumptions in advanced engine designs. Technological advances in almost every avionics hardware area and in the methods of utilizing components will sharply reduce the amount, and the weight and size of the hardware, and will greatly increase the reliability of the systems. This latter improvement, combined with other reliability improvements, will significantly increase the logistic feasibility of the concept of widely dispersed basing of aircraft--down to the level of a few or a single aircraft per ship.

Digitized by Google

The ability to operate manned aircraft from many ships of the navy throughout a task force allows increased area surveillance, targeting and identification of potential targets, thereby permitting surface combatants to exploit more fully their standoff missile capabilities.

For at least 20 years, the Navy has been studying the V/STOL concept, but never to operational fruition. The Harrier (AV-8) procured by the USMC has been operated very successfully from remote sites ashore, amphibious ships, and aircraft carriers, notably the U.S.S. *Franklin D. Roosevelt*. Foreseeable technological advances in airframe construction, propulsion techniques, and avionics packaging strongly indicate the feasibility of V/STOL. Now behind the bulwark of 12 aircraft carriers, and no follow-on aircraft requirements imminent, we have the time to conduct at a deliberate pace an in-depth investigation of V/STOL.

Our basic plan in the Navy is to insure that we continue to provide the air power at sea which enables the U.S. to maintain maritime superiority over the Soviets. This we intend to do with our twelve large deck carriers and their multi-purpose air wings. Until recently, this versatile sea based air with only found aboard our aircraft carriers. The subsequent addition of manned tactical aircraft to other types of ships and areas of warfare has enormously expanded their individual, and therefore the navy's, capabilities for carrying out our nation's mission. For example, employing assault helicopters aboard amphibious ships added an entirely new dimension to the assault force. The addition of the Lamps helicopter to the surface combatant greatly expanded the ship's ASW capability and provided an urgently needed over-the-horizon targeting capability.

Our future plans are to continue the exploitation of sea based air across the spectrum of naval vessels by adding air capability to more ships and improving the existing capability aboard others. The Navy must remain progressive, innovative and at the forefront of technology in order to cope with the ever increasing threat.

In order to meet the future threat, we are investigating various methods to confound the enemy. Diversity of forces is the predominant advantage of V/STOL. The ability to widely disperse our force, yet maintain task force integrity, geometrically complicates our adversary's problem. His questions are: Which target is the high value unit? Where is his command center? What are his defenses? Where is his offensive punch?

Fleet disposition options are limitless. You may have ships scattered 300 miles apart, yet still, through the use of planned future command and control systems, exercise discrete command and control.

To accomplish the foregoing, V/STOL aircraft must have mission capabilities competitive with conventional naval carrier based aircraft: Fighters capable of air superiority, attack aircraft capable of penetrating intense air defenses at long ranges with useful loads. The feasibility of V/STOL has been proven with the Harrier and other aircraft. The challenge lies in the development of an aircraft that will satisfy our mission requirements. The technologies required to develop a mission capable V/STOL appear to be available in the foreseeable future.

The primary objective in the navy is to improve readiness. One way to assist in this effort is to reduce the number of different types of aircraft that are supported in the fleet. As a further step in this direction, we envision the possibility of two basic types of V/STOL aircraft to satisfy many of our missions. The first grouping, called Type A for convenience, will include subsonic multimission aircraft. Versions of this type will perform such tasks as antisubmarine warfare, airborne early warning, carrier on-board delivery, and marine medium assault. A second grouping, type "B" V/STOL, will be high performance multimission aircraft, versions of which will perform such missions as fighter and attack.

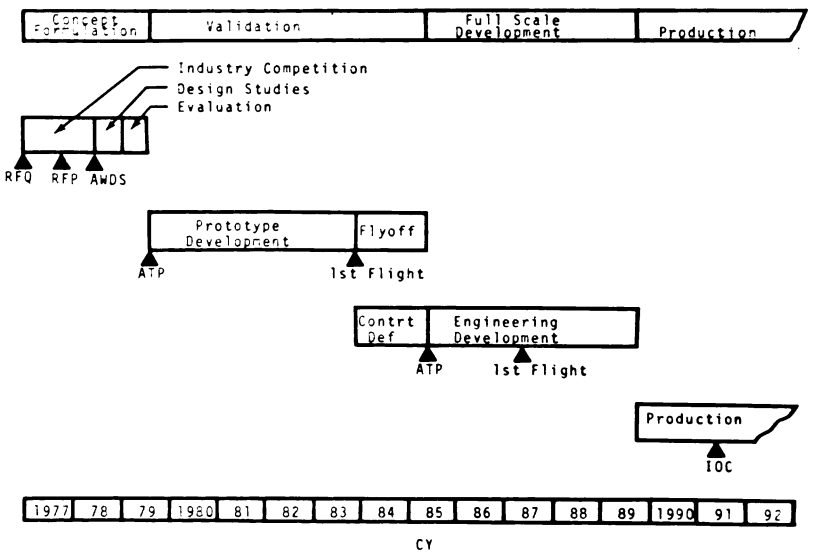
Assuming that V/STOL aircraft can be successfully developed, they should become available in the 1990's. At that time we will begin an orderly replacement of aircraft that are planned to retire in that same time period. For example, the estimated IOC of the type "A" is 1991. The S-3 and E-2 begin retiring in the early 1990's and the CH-46 in about 1990, after completing a service life extension program. The expected IOC of the Type "B" is 1995. The F-14 and A-6 begin retiring in about 1995.

The implementation of this V/STOL plan will take the ingenuity of all the U.S. aerospace industry.

In compliance with OMB Circular A-109, the Secretary of Defense approved the mission element need statement in 20 January 1977.

Digitized by Google

TYPE A V/STOL PROGRAM



A phased development program for the Type A V/STOL aircraft weapon system is planned and is highlighted on this slide. During the concept formulation phase, industry will be solicited for broad conceptual ideas of operational V/STOL weapons systems.

Following an assessment of the information received in response to this unfunded solicitation, a request for proposals will be issued to all interested offerors in late 1977. Based upon evaluation of the responses, several contracts for aircraft, engine and avionics conceptual studies will be awarded. These studies will define operational Type A V/STOL weapon systems, establish realistic performance and cost goals, identify major areas of risk and formulate detailed total development plans.

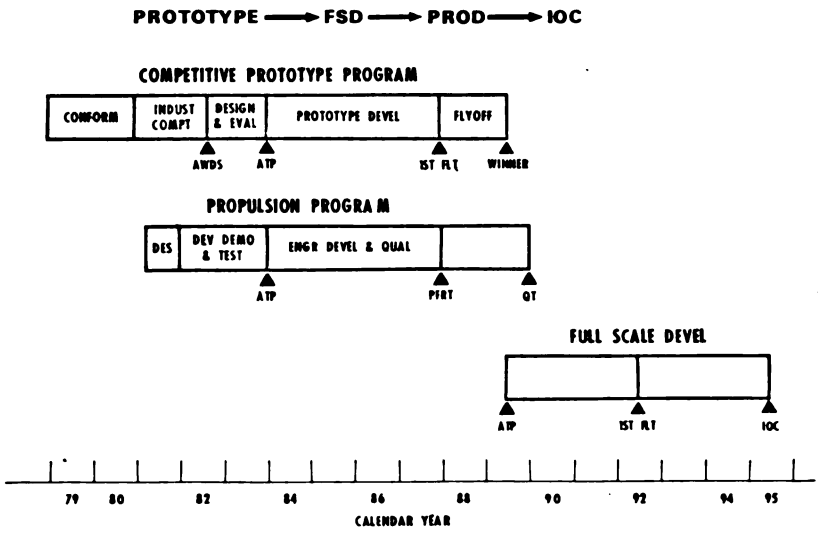
During this validation phase, design, fabrication, test and evaluation of competitive prototypes, including engines, and hardware demonstration of critical avionics technology will be conducted. Full scale engineering development and follow-on production will lead to an IOC in 1991.

Authority to proceed (ATP) for the validation phase is contingent upon successful completion of concept formulation. The first flight date for the prototype is constrained by completion of a Preliminary Flight Rating Test (PFRT) on the engine. Initiation of full scale development (engineering development) is contingent upon successful completion of the validation phase. The current schedule is necessarily tentative and subject to change as the Type A program proceeds.

The airframe and engine contractors will be solicited, by means of an RFP, to prepare proposals for development of aircraft prototypes. Two airframe contractors and two engine contractors are expected to be selected for award of contracts for development and fabrication of prototypes, and for competitive flight testing. Thereafter, an airframe and engine contractor are expected to be selected for full scale development of a Type A V/STOL weapon system, including avionics.

Digitized by Google

TYPE B V/STOL



Concept formulation studies for a V/STOL Type B have pust commenced. As shown on this viewgraph, it is envisioned that a Type B development plan similar to the Type A's will be initiated in about 1980 for an IOC of 1995. These concept formulation studies are looking not only at aircraft and its systems, but the new air-to-air and air-to-ground weapons that could be developed in the 1990's to determine how best to perform the fighter and attack missions. This is really the philosophy with which we are approaching the whole V/STOL program. Take a step back and review how best to perform tasks, where should weapons be carried, i.e., on the ship or aircraft, what technologies or weapons which could be developed would have the highest payoff when coupled with the flexibility that V/STOL provides. For example, we are looking at the ability of an aircraft to provide a forward pass capability to a surface launched surface-to-air missile. Thus, if we could forward base our aircraft on picket ships and they could target incoming raids, maybe it would be more effective to surface launch a majority of the weapons? This is the kind of question we are asking ourselves. How best to utilize all our limited Navy assets—ships, air and submarines.

A continuing analysis effort in support of the V/STOL program will delineate the operational utility of the total V/STOL concept. This study is analyzing alternate operational concepts, defining precise utilization of all V/STOL aircraft types and establishing appropriate force mixes.

This series of studies is continually addressing the questions mentioned earlier:

Does V/STOL satisfy the navy's needs?
Is the concept feasible?
What is the overall life cycle cost?

V/STOL R. & D. FUNDING, JANUARY 1977

Title	Fiscal year—				
	1978	1979	1980	1981	1982
Adv V/STOL type A	28.186	56.683	106.689	203.275	421.719
V/STOL supersonic B			4.824	4.824	26.264
V/STOL support	8.258	33.094	34.931	35.570	42.285

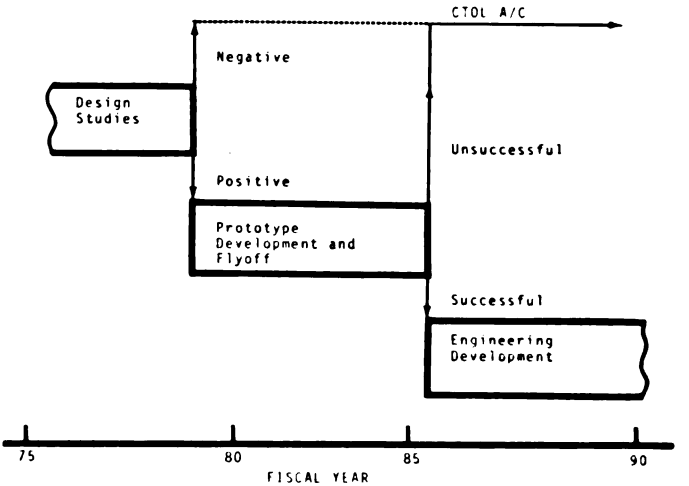
Digitized by Google

The current R&D V/STOL funding as displayed here is dedicated for the subsonic and supersonic aircraft and their supporting technologies. Unlike other programs, the program manager is responsible for both the aircraft R&D line and the supporting technologies in order to maintain program integrity and prevent redundancy of effort.

Now, in concluding, is the Navy committed to an irreversible path? The answer is a definite no!

Our system of checks and balances is in line with the key decision points of V/STOL. For if V/STOL fails to satisfy our requirements, we have alternate courses of action.

VSTOL DECISION POINTS



This chart depicts two V/STOL type "A" decision points and their relationship to naval aviation planning. As previously mentioned, the initial phase of V/STOL consists of design studies with industry.

If these studies indicate that V/STOL could not satisfy our requirements, then no design effort would be required until it was time in the mid 1980's to establish plans for a follow-on conventional aircraft.

However, if as expected, the design studies are positive, then we would continue with the development program.

The technical risk of V/STOL and the degree of emphasis that the Navy wants to place on V/STOL fully warrant a competitive prototype flyoff. This flyoff will be completed in 1985 which is another major decision point.

If the prototype flyoff is successful, the program would continue into a normal engineering development similar to the development cycle of a fixed wing aircraft today.

If the flyoff failed to provide convincing evidence to proceed with V/STOL, the program would be redirected toward a conventional multi-mission aircraft to fulfill the same tasks. Since a prototype flyoff would not be warranted due to the relatively low development risk of a conventional aircraft, it could have an IOC in early 1990's. The point is, we have this period between now and 1985 to thoroughly investigate V/STOL through a prototype flyoff without jeopardizing our required replacements for carrier-based air in the early 1990's. This has led the Navy to the conclusion that the time is right to pursue completely the feasibility of V/STOL.

But what if the program should fail at some point? Say after the prototype competition? What have we lost? Our aim would be for a common airframe to perform the ASW, AEW, COD and tanker missions. Therefore, the multimission design is a part of our future planning regardless of whether V/STOL or conventional. The majority of our planned V/STOL design work would very readily

Digitized by Google

be redirected to a conventional aircraft should the V/STOL program fail. All of the avionics and weapons work is directly applicable. All of the technology items such as composite materials and lightweight systems have direct application. The basic propulsion system could have application. Thus, we think the technology and design work has a very high recovery factor if our course changes.

The Navy is proceeding rapidly with a detailed appraisal of V/STOL. Preliminary operational and technical studies indicate high potential. We believe that the success of the program is a very effective means for getting the required numbers of manned aircraft at sea to perform the missions of the Navy. V/STOL has the potential, as a fallout of our program, to vastly expand the combat capabilities of many of our surface combatants and support ships. The potential is, therefore, a major step forward in fleet flexibility utilizing the ability to operate air assets throughout the task force and expand significantly the surveillance horizons of the fleet.

Behind the bulwark of 12 large deployable aircraft carriers, there is no risk in the Navy's warfighting capability during this development period. The only risk we face is cost, but even here, there is a very high recovery factor for application to any other new naval aircraft. From an operational viewpoint we feel strongly that V/STOL is a necessary step for the Navy, and we are moving ahead.

Mr. Chairman, the Navy recognizes the challenge but appreciates more the potential of V/STOL.

Gentlemen, this concludes our presentation.

Mr. CROMWELL. Will you provide for the record a detailed chronology of the Navy's examination of V/STOL, starting with the Chief of Naval Operations direction that was given in March 1975 to review its potential. And would you please list the various reviews and studies of the records which have occurred, and give a short descriptive synopsis of each such event, for the record, please.

Captain DUNLEAVY. Yes, sir.

[The information follows:]

In March 1975, the CNO's V/STOL direction was summarized as follows:

"In the past several years, vertical lift aircraft found application and use in virtually every area of naval warfare. This demonstrates the wide range of future potential applications of vertical life aircraft for the Navy and this baseline of experience presents a point of departure in determining the future requirements for this type of aircraft. It is now necessary that an in depth review and analysis of the full spectrum of vertical lift applications and warfare concepts be conducted which addresses the question of requirements for VTOL/VSTOL aircraft and, if so, an identification of the missions and the platforms to be used. This study should culminate in a succinct VTOL/VSTOL concept which will provide continuity and consistency in our aviation programs as the Navy addresses a wide range of decision alternatives. The essence of this policy is to ensure (in this area as in others) that the Navy's scarce resources are only applied to vertical lift applications which are clearly cost effective, while avoiding marginally effective and less certain applications.

"Accordingly, OP-05 in coordination with CNM, OPs 06, 03, 090, 095, 098 and the Marine Corps, is to conduct a warfare concept study to review the future of vertical lift aircraft. This study will parallel the previously directed studies on the CVNX and VSS. It should further include consideration of all air capable [illegible]face platforms. Fleet Commanders and Commanders of the Systems Com[illegible]s are to be included in the development and evaluation of the Concept."

[illegible] April 1975, the Navy V/STOL Warfare Concepts Study was initiated based [illegible]dance in the preceding paragraphs. The study was to formulate [illegible]ts for Navy VTOL/VSTOL aircraft and identify the ap[illegible]cept and development schedule which would provide con[illegible]in Naval Aviation programs.

[illegible]6, based on the initial output of the Navy V/STOL study, [illegible] concept was presented to the CNO. The CNO indicated that [illegible]t was imaginative and yet kept an air of reality about it [illegible]ng and schedule.

Digitized by Google

The CNO stated that this study effort was particularly timely in view of the recent decision by the SECDEF to ask for a revised Navy shipbuilding program to improve the Naval force in face of the growing Soviet Naval capability which was being considered by a National Security Council Study. He further stressed that the Navy should prepare a forward-looking force structure.

The CNO tasked the VCNO to organize the OPNAV staff to further develop the concept and to support it in all planning and to immediately convene a V/STOL Program Steering Group. This Steering Group, composed of most of the major OPNAV Force and Mission Sponsors and Directors of R.D.T. & E. Program Planning, together with representatives of the Commandant of the Marine Corps and the Naval Material Command, was designated on 9 February and held the first meeting on 10 February.

Based upon various meetings of the V/STOL Program Steering Committee, a Study Directive for the Naval V/STOL Implementation Plan was issued by the Director of Navy Program Planning on 1 March 1976. This directive reiterated the CNO approval of the baseline V/STOL concept presented on 5 February, and directed further study as a matter of high priority be dedicated to refining the conceptual aspects with a logical plan to introduce V/STOL airplanes into the Navy aircraft inventory. The plan was to establish the time-phased requirements and resources necessary to effect the initiation of a V/STOL program across the spectrum of naval aviation in the FYDP years and beyond. It would determine the structure necessary to provide the Department of the Navy with a compatible V/STOL aircraft and platform capability for tactical air.

In late March 1976, the Director of R.D.T. & E. inserted and obtained approval for a planning wedge for Type "A" V/STOL in the Sea Control Summary of the 1976 CNO Program Analysis Memorandum.

In May 1976, the President requested additional funds for the pursuit of V/STOL in his FY 1977 Budget Addendum based upon preliminary results of the National Security Council Study.

On 21 May, the Navy Director of Program Planning directed that a V/STOL Concept Rationale Paper be prepared describing the utilization of various current aircraft and platforms in the Sea Control and Power Projection Missions and an overall plan to transition to V/STOL. The Concept Rationale was provided on 11 June 1976.

Following interim Study Group reports in April and May, including the notional V/STOL Operational Requirements, the V/STOL Steering Group received a series of briefings by Navairsyscom in July on the status of their efforts to structure a notional Type "A" V/STOL aircraft which would meet the performance objectives of DCNO (Air Warfare) notional Operational Requirements. The resulting notional aircraft were judged by the V/STOL Steering Group to be too large, too expensive, and required too long to develop. This outcome required Navairsyscom to develop sensitivity studies about the notional designs to show the impact of varying the notional requirements. The presentation included a proposed development schedule for the Type "A" V/STOL which utilized a competitive prototype fly-off prior to engineering development and leading to a projected IOC in 1991.

The decision was to proceed with the recommended development plan and the tenets of OMB Circular A-109 by issuing to the aerospace industry a solicitation for information in late 1976. This unfunded solicitation would request conceptual designs and design tradeoffs using notional operational requirements and Navairsyscom design guidelines. The solicitation would reflect all the TYPE "A" versions (ASW, AEW, COD, Tanker, USMC Assault) as well as the sizing requirements necessary to operate the V/STOL aircraft from many different ships (CV, VSS, CSGN, DD-963 and others).

(U) The RFQ/I responses will be analyzed by Navairsyscom. From these responses, four or more designs will be selected for funded detailed follow-up conceptual design studies; two or more engine companies will also be funded for follow-up design study.

In September 1976, the CNO and the CNO Executive Board received a presentation on the status of the V/STOL Study Report. The presentation reviewed the notional requirements for various mission variants of V/STOL aircraft, recent ship compatibility studies and progress of the TYPE "A" V/STOL design and development plan. Funding implications and the state of technology inherent in the V/STOL development were addressed. Options were also presented for future marinization of the AV-8B.

Digitized by Google

The CNO made the key point that if proven feasible, the ultimate development and shift to a V/STOL concept appears inevitable but that the point in time when CTOL/VSTOL capabilities merge is difficult to currently predict. However, the inherent risks in total reliance on the ultimate development of V/STOL will be reduced by retaining sufficient CV/Tacair assets to assure a well-ordered transition from CTOL to V/STOL. Current CTOL capability should be maintained while developing yet uncertain future V/STOL capabilities. The CNO stressed the need to reassess the confidence level of current V/STOL engineering assumptions to ensure they are commensurate with the Navy's investment and assets.

The decisions were as follows:

(*a*) The results of the V/STOL Study Report fully supported proceeding with accelerated study of the V/STOL concept and its development.

(*b*) A definitive commitment on the AV-8B options will be temporarily deferred. However, the Navy must make a decision by DSARC II, presently scheduled for June 1979.

(*c*) A well coordinated plan must now be developed to further proceed with V/STOL TYPE "A" development. Considerations in this plan will include: an adequate management team at the project manager level; funding plans; tradeoff priorities and milestones.

(*d*) Under the guidance of the VCNO, the V/STOL Steering Group will continue with additional advanced studies for V/STOL concept and development. In addition, direct special attention to: Staffing requirements for a project manager office; refinement of ship compatibility criteria; possible V/STOL IOC dates and their effects on related system developments in the Navy; minimizing mission sponsor responsibility overlap; definition of the TYPE "B" and "C" V/STOL; and determine resource shortfalls for future R&D funding as V/STOL further evolves.

Following the direction given by the Assistant Secretary of the Navy (Research and development) on 18 January, the iterative concept formulation effort will be constrained within rational achievable funding profiles. No particular design has been predetermined in any way and there are no fixed preconceptions of which missionized versions (ASW, AEW, etc.) of the Type "A" V/STOL will be produced first.

In accordance with the new DOD 5000.1 and 5000.2 of 18 January 1977 and OMB Circular A-109, the Mission Element Need Statement on Seabased Air was signed by the Secretary of Defense on 20 January 1977, the Request for Quotations for Information (RFQ/I) to industry was released on 11 February 1977, and the industry responses are due on 31 May 1977. After reviewing industry responses, updated operational capability information will be provided to an operational study group. By late summer 1977, the initial draft of the V/STOL Operational Concept, and some tentative guidelines on specific operational requirements will be available. An RFP will be prepared for industry studies at that point. Subsequently, the parallel developing operational concepts and design concepts will continue as an iterative process until early 1979.

DEFINITION OF TYPE A V/STOL

Mr. CROMWELL. You defined the type A V/STOL here. This committee looks at the mission functions of TacAir as being combat aircraft and combat support aircraft. We have arbitrarily defined combat support aircraft as tankers, reconnaissance, airborne early warning, electronic warfare, airlift, and in several subsonic cruise type of vehicles.

Are you planning or hoping to replace all of the Navy's different types of aircraft that fall into that function with one air vehicle? Is this the objective?

Captain DUNLEAVY. That is our objective; yes, sir. I will supply the information to your first question.

[The information follows:]

We intend to have missionized variants of a single basic aircraft configuration perform the missions of AEW, ASW, Marine Assault, Tanker, COD and Search

Digitized by Google

and Rescue. We also intend that the V/STOL "A" have some capability for standoff surface strike and some electronic warfare capability. The missions will be divided among the variants in the most effective manner, based upon the evolving operational concepts for employing V/STOL.

Mr. CROMWELL. How large a vehicle will that type A V/STOL be, at least according to the current design studies done by the Naval Air Systems Command?

Captain DUNLEAVY. What we desire is to have an aircraft that will go and operate throughout the fleet from platforms ranging in size from the DD–963 up to the large *Nimitz*-class carriers. Current studies we have done in the Navy indicate that by using current technology, the aircraft would be a bit large for the small platforms, but follow-on information requests are going out to industry right now and asking them their ideas. We should have that feedback in May of this year. Subsequently we will have a better estimate of the size of the aircraft.

Mr. CROMWELL. How large a vehicle, according to the current design studies of the Naval Air Systems Command is the type A?

Captain DUNLEAVY. Right now, the initial number is 52.48 feet.

Mr. CROMWELL. How much does it weigh—53,000 pounds?

Captain DUNLEAVY. It ranges in weight, sir, from 40,000 to 51,000 pounds, depending on performance tradeoffs.

Mr. CROMWELL. Is Mr. Dentel here?

Admiral TURNER. We have the project manager who is organizing it and beginning this program.

Mr. CROMWELL. Mr. Dentel, what did the first Navy studies look at for the type A V/STOL and what capabilities are they looking at and how large a vehicle did they come up with for weight and size?

Mr. DENTEL. Well, there have been studies for about a year and a half. About 6 to 8 months ago, there was a fairly serious look at the concept and it appeared feasible. The size of the ASW vehicle was around 51,000 pounds at that time utilizing state-of-the-art structures and design concepts.

It was a two-engine vehicle. It was soft in some areas, particularly in the propulsion area.

We used the weight and size of the S–3 avionics and, of course, we hope to reduce that substantially, using planned technology advances.

We also hope to pick up some significant weight savings in the composite area in the airframe.

Mr. CROMWELL. Thank you. If you can, amplify any of these questions in the record we have got about 10 more minutes, and then we will leave it open for the record.

[The information follows:]

This is based on using only current state of the art for meeting the full performance of the S–3 type mission.

TYPE B V/STOL

Mr. CROMWELL. Do you have any design information on the likely size of the type B, or combat V/STOL aircraft?

Captain DUNLEAVY. Here again, we haven't finished the analysis. We are looking for it, again, to operated from the 963 up to the *Nimitz* class.

Digitized by Google

We are doing our Intel studies. We haven't come to the final figures.

Mr. CROMWELL. Now, a 50,000-pound airplane is a little large for the 963 destroyer.

Captain DUNLEAVY. Yes, sir.

[Following information was submitted later:]

While extensive in-house design efforts have not recently been undertaken nor has industry been recently queried on advanced concepts, based upon resizing the aircraft from previous V/STOL fighter-attack studies, it appears possible to develop a Type "B" V/STOL that would equal the general current F-18 performance and be in the 35,000 pound category. This 35,000 pounds would be for the vertical take-off mode, range and payload would probably be somewhat less than the F-18 capability but the range and payload would be substantially increased in the STOL mode. The actual performance to be achieved will be highly dependent upon the use of advanced technologies particularly advanced propulsion available. The V/STOL "B" aircraft is also presently intended to replace the A-6 and F-14 aircraft in the Navy inventory in the mid-1990's. This replacement is not envisioned as a direct mission-for-mission substitution but must be integrated within the total Navy V/STOL concept. Three major areas being investigated to accomplish this are (1) the massive weight/volume reduction effort being undertaken in the area of weapon avionics systems to allow the extension of V/STOL weight restrictive mission requirements, (2) the development of highly effective, very light airborne weapons and (3) the concept of launching from other platforms the heavier, long range weapons, under V/STOL "A" control, against extended range air and surface targets.

TYPE C V/STOL

Mr. CROMWELL. What is the type C V/STOL? What would it do and how large would it be?

Captain DUNLEAVY. We look for the type C to be a follow-on to our Lamps helo in the late 1990's or the year 2000.

Mr. CROMWELL. How large would it be?

Captain DUNLEAVY. Again, we would like to have it as small as possible.

TECHNICAL RISKS WITH V/STOL

Mr. CROMWELL. What is the technical risk involved in this V/STOL program? How does the Navy assess the technical risk?

Would the program manager want to take that one?

Captain DAPOGNY. Captain Dapogny of Navair, program manager.

A summary description of the technical risk of this program is that it is a very high technical risk. You have to say it is a very high technical risk, even if you pursue it on the multiphased, very carefully designed schedule that Captain Dunleavy showed you a few minutes ago.

It is a type of program in which you would have to do a great deal of work very early in the program to try and identify your risk, and set up a great deal of management in the risk control area, probably some parallel developments are required. One of the major factors that we are looking at to control risk in this program, or to make up for the risk, is a very substantive amount of competition all the way through advanced development.

Mr. CROMWELL. All right. If you would supply for the record some specific areas where you feel there is risk, identify the type of technical item it is, and then what needs to be done to bring it up to the state of the art required, that would be appreciated.

Digitized by Google

[The information follows:]

Three basic factors create a general requirement resulting in a very high technical risk program. First, a single basic configuration is desired, from which we can derive variants for the many different subsonic missions. There is a great technical challenge in the satisfaction of disparate needs in a volume and weight critical aircraft. Second, it is desired that the aircraft operate effectively from both very small platforms (in a vertical takeoff mode) and platforms as large as a CVN (in a short takeoff mode). Third, it is desired that aquantum improvement be made in reliability, and that very great improvements and changes in approaches be made in all supportability matters. The solution to such a complex and demanding requirement involves innovative design concepts and a broad advance of technology in every area of the aircraft. Some specific examples of the advances we presently view as required are as follows.

In the area of propulsion, we require a great increase in overall propulsive efficiency and a low thrust-to-weight ration for the total propulsion system. In almost all design concepts discussed to date, this consists of a gas generator, a cross-coupled drive system, and a thrust augmentation device, such as a lift fan or a rotor. The gas generator will apparently have to operate at higher temperatures and with significantly improved specific fuel consumption. In a lift fan design concept, a very large diameter fan, efficient to both zero forward airspeed and cruising airspeed, must be developed. This dual efficiency requirement, and the use of the fan as a major flight control system in the vertical mode, requires a variable, fast dynamic response fan.

In the airframe area, we must seek significant weight reductions in all areas. We have low weight technology programs underway for such subsystems as electrical power generation, environmental control, and hydraulics. In the structures area, we are hoping to attain more than double the percentage usage of composites. Techniques must be developed to enable applications in such as nacelles, landing gear component, load bearing sections of the fuselage, and wing attachment fittings.

In the avionics area, we are seeking an extreme reduction of both weight and volume. In addition to finding viable methods of making comprehensive use of the latest extreme component miniaturization techniques, we will achieve a very large reduction in the total number of components by developing a totally integrated system architecture by utilizing standard languages throughout, combining functions into single components, and using total multiplexing techniques. Data transmission must be changed from the extremely large number of individual wires which carry low-data rate signals to a very few fiber optic channels capable of extremely high data rate transmission. This last item will help solve the EMI problem, which becomes even greater in aircraft with extensive application of composites.

The area of the AEW radar is critical. If feasible, we would depart from the use of rotordomes, which are inherently weight and drag problems and which impose significant supporting structure penalties on the basic aircraft design. Conformal and other antenna array approaches must be developed in this case. The attainment of this approach is heavily dependent on such items as new antenna components (such as solid state RF receiver-transmitter modules), new pulse compression techniques, and coherent digital postprocessing. Even settling for a small rotordome would require significant technological advances.

In the area of flight characteristics, the V/STOL "A" requires a high degree of physical integration of a large number of subsystems, all of which have yet to be developed. The operational task of landing a V/STOL "A" on a small platform in all-weather, rough sea operations is very demanding on the pilot and the dynamic responses of the air vehicle. Advanced displays of increased amounts of flight situation information must be developed. Additionally, an all-weather approach landing system which can bring the aircraft to its landing point in the vertical mode is being pursued. A multi-engine digital engine control is being developed to attain large, accurate, and instantaneous thrust modulation. Finally, an advanced digital flight control system (requiring no manual backup) will be developed to integrate the operation of all thrust vectoring and aerodynamic control devices.

The reliability, maintainability, and other supportability improvements will require many state-of-the-art advances in a large number of items.

Digitized by Google

The complete V/STOL "A' 'program structure has been designed to accommodate a large number of significant technological advances in a controlled manner, which would provide a high probability of success despite the high technical risks involved. However, it has not yet been completely and solidly established by analysis that the attainment of the very demanding program objective is feasible. We are heavily involved with industry and our in-house engineers and analysts in a comprehensive, vigorous concept formulation effort. At present we believe that it will take until 1979 before we know whether or not we can, and exactly how we should, proceed into advanced development with a high probability of success. It is extremely critical that we be allowed to pursue this concept formulation effort fully, as requested in the fiscal year 1978 budget submission.

VEHICLE FLIGHT EFFICIENCY

Mr. CROMWELL. What is the individual efficiency of a V/STOL aircraft as compared to a conventional aircraft? Is it correct that the efficiency in terms of range/payload of a V/STOL is not as good as a comparable conventional airplane because of inherent design factors such as lower lift-drag ratios and also higher engine thrust required for V/STOL airplanes?

Captain DAPOGNY. If you were launching both of the aircraft off of a CVN and you were launching the V/STOL in its STO mode, you would have a rather obvious degradation problem because of the inherent design nature differences in the V/STOL.

However, we do not look upon that particularly as a penalty in the program. The great flexibility that V/STOL offers is to disperse this aircraft and to operate it in very different ways. This would allow you to have a slightly less unit capability in each of the areas and yet achieve perhaps a significantly greater force capability overall, even with the same number of aircraft.

Mr. CROMWELL. I didn't mean to sound critical with the question, but I did want to get on the record the fact that a conventional aircraft inherently is a more efficient vehicle than a V/STOL. There is a penalty in performance in going to V/STOL.

Captain DAPOGNY. Yes, sir, that is thoroughly so.

[The information follows:]

Given current technology in both the conventional and V/STOL vehicles, there is a given performance penalty; however, as the significant weight reductions are realized by technological advancement, that penalty or weight delta will decrease, since the impact of a given weight reduction on design is greater in the V/STOL aircraft than in the CTOL. Weight reduction not only affects the structural designs, but directly affects (reduces) propulsion requirements which reduces engine size and weight and in turn affects the structural design from that aspect. The same rationale is generally true of the CTOL aircraft but to a lesser extent. The V/STOL aircraft must physically lift each additional pound of weight at greater than a one-to-one ratio with engine thrust while the CTOL ratio is significantly less than one-to-one.

OPERATIONAL ASPECTS OF V/STOL

Admiral PETERSEN. May I add one thing, sir? I think you must, at the same time, consider the fact that that conventional efficiency requires a very high energy catapult, a very large ship, and a very high energy arresting gear, in order to operate in the maritime environment.

Admiral TURNER. If I may add just another comment, I think we are also looking for the potential and the promise to use these aircraft on the smaller ships that have never been able to do so in the past.

Digitized by Google

While we have been talking about sizes and weight, really I think we are trying to address it in terms of a military—a need or requirement or a potentiality to operate something from the 963 class frigates or from nonaviation-type ships.

So, penalties, yes, but still, greater opportunities to do more with smaller aircraft than we have never been able to do before.

I don't think we are envisioning trying to operate very large V/STOL from the back end of a DD–963, not at all, but something smaller yet able to accomplish over-the-horizon targeting, to give impending knowledge of other forces, to provide assistance, detection, surveillance, so that those platforms and their weapons can be employed much more effectively than heretofore was ever thought possible.

So there are some gains which kind of excite us in that area and even though we are starting from a penalty point, I think it is kind of balanced out by some of the possibilities.

Mr. CROMWELL. My next question was going to be, what are the advantages of V/STOL as to carrier air operations and what has been found so far with the operational trials using the Harrier on the *Roosevelt*.

You can supply something of a summary for the record.

Admiral TURNER. We would be happy to.

[The information follows:]

The AV–8A Harrier was smoothly integrated into the cyclic flight operations aboard the U.S.S. *Roosevelt*. The AV–8A was deployed as an integral part of the Air Wing and not as an operational evaluation test. Reports from the Commanding Officer, U.S.S. *Roosevelt*, have confirmed this fact and highlighted many advantages that the AV–8 has offered to the carrier. The F–4N's, A–7B's and AV–8A's of CVW–19 have operated together, day and night, in fair weather and foul, and the AV–8A has performed several of the CV missions.

In the launch cycle the AV–8's were off consistently faster than the CTOL aircraft, even with both catapults in use. The VTO mode, coupled with the self-start capability, provides faster reaction times. With its independence from catapults, the AV–8A has launched from both the angle and axial decks at launch times other than with the CTOL launch. With the vertical landing mode of recovery, the time required for a recovery was less than that for a CTOL. There have been no AV–8a bolters to date. The independence from arresting gear allows almost unlimited use of the flight deck for landing. This has allowed the AV–8A's to recover during normal underway launch, respot and the recovery periods.

AV–8A's flew during the *Roosevelt*'s transit to the Mediterranean when maneuvering restrictions on the ship did not allow F–4 and A–7 aircraft flight operations. When the ship was in port, the AV–8A's provide a defensive and offensive capability, not otherwise available.

An example of V/STOL permitted flexibility was demonstrated during an AV–8 inflight emergency. The AV–8 was recovered with no difficulties, no ship maneuvering, and no impact on the cyclic operations. Another example was illustrated by the AV–8A's cross-decking to the U.S.S. *Guam* (an LPH) and conducting flight operations on short notice.

In summary, the AV–8A experiences on the U.S.S. *Roosevelt* have been very successful and have demonstrated some of the advantages of V/STOL.

MISSION FUNCTIONS OF A CARRIER AIR WING

Mr. CROMWELL. Now, in looking at carrier air wing requirements, Admiral Turner, in light of your discussion today of your utilization of the carrier air wing in that scenario in 1973 in the Mediterranean, will any of the mission functions of your carrier wing be

Digitized by Google

changed as you go to V/STOL, or do you still have to perform all the same basic functions?

Admiral TURNER. As we indicated here, we are starting from the point of view of what we have and what we need to continue the functions being performed by present aircraft which are due to be replaced at some time in the late 1980's or early 1990's. We found that the functions and the needs for replacement lend themselves to a grouping, which we have indicated for convenience, as A and B.

Our intent is to continue to do the kinds of things we have to do with V/STOL aircraft that possibly offer us the opportunity to accomplish these functions in different places or more places. We may find new combinations.

I hope we find that we can reduce the numbers of different kinds of aircraft on an aircraft carrier. We are now working with too many different kinds of airframes, engines, support equipment, et cetera. It is our long-range goal in naval aviation to reduce the numbers of different types.

Hopefully, then, with the inventories of very fine aircraft we have now and their inherent capabilities, the modification programs we have to keep them going and viable, there is time to look at ways we can restructure our naval aviation force to fewer, more common airframes, involving the vertical or short takeoff landing mode and arrive at a more manageable, more efficient fleet of aircraft to do the same functions in the fleet of the early 1990's. If we have the same kind of a confrontation, we will have the same requirements for knowledge of the location of the enemy, what are his dispositions and movements, what kind of weapons does he have? How are we going to keep track of him day and night? And how would we react?

Or, if we are standing off, how do we go and find him and attack him, how do we defend ourselves?

So I think the functions remain the same. We are hopefully looking for a different combination of platforms, again, maybe fewer in number, that can do the same multiplicity of functions that are required in carrier aviation.

EFFECT OF CARRIER SIZE ON AIR WING

Mr. CROMWELL. If you look at today's air wing on one of your large carriers, you have 60 combat aircraft plus 4 radar warning airplanes, 4 electronic warfare airplanes, 3 reconnaissance planes, 4 tankers, you may throw in 10 ASW airplanes or more, and you may mix those up a little bit.

But if you went to a smaller carrier with V/STOL airplanes on it, would you need about that same mix? And how would you achieve it on a smaller carrier?

Admiral TURNER. I think the notional air wing you are looking at was one which would fit on the *Nimitz*. Her extensive space can easily accommodate this number of platforms and is a great advantage to us. Not only that, but she has a tremendous inherent command control and logistics base which supports all these different kinds of aircraft.

If we go to a smaller aircraft carrier, quite obviously we run into more limited space considerations, fewer support facilities, fewer

Digitized by Google

command and control activities, repair facilities, and the like. It will become evident that we can only support fewer numbers, certainly fewer numbers of conventional types of aircraft.

But perhaps, again, V/STOL might offer us a way to have a higher deck loading. That will only come out in the future, but certainly in the ultimate, if they could all land and take off vertically, the given acreage would support more aircraft. But the question is, would the hull underneath the flight deck support the weapons, the logistics, the repair, the berthing facilities, the command and control essential to employment of the aircraft?

So it is a trade off in all of these various functions to produce an operable, multipurpose, and creditable naval aviation carrier force.

We have looked at combinations of different numbers of aircraft to take advantage of both the platform and the capabilities of the aircraft. But essentially going to smaller ships makes the problem more difficult.

Mr. CROMWELL. Well, I wondered if you felt, from your own experience, that you could cut down on the numbers of those combat support airplanes; the radar warning, of which you need 4 today; the electronic warfare, where they feel they need 40 EA–6B's; 3 reconnaisance; you need 4 tankers, and so on and so forth.

If you want to amplify that for the record. We have got to clear the room in about 3 minutes for the R. & D. subcommittee.

Admiral TURNER. OK. Yes, I would like to amplify that.

[The information follows:]

I consider all carrier airwing aircraft as combat aircraft. Those aircraft that have often been categorized as combat support simply because they do not deliver weapons against the enemy are a vital element of the Carrier Combat team. In fact without them, the weapons carrying aircraft would be severely handicapped. In most cases the current numbers are the minimum for any sized carrier air wing and therefore will not vary even with the future VSTOL wing. The fact is that in the case of both the E–2 and EA–6B we require a minimum of four aircraft in order to maintain the necessary airborne capability. Three reconnaissance aircraft are required to ensure that capability is available on each cycle. During actual combat operations we routinely deployed four reconnaissance aircraft in order to provide adequate pre and post strike reconnaissance. Tanker aircraft extend the capabilities of the air wing. Four tanker aircraft ensure the capability of maintaining one airborne for safety considerations, and also allows us to launch all four when necessary to significantly extend the air wing capability. In summary, I would not consider a reduction of these vital combat aircraft to be feasible in either todays or future air wings.

TOTAL FLEET EFFECTIVENESS STUDIES

Mr. CROMWELL. The Navy in the past has done several fleetwide cost effectiveness studies to analyze force structures in the total fleet. The Seamix and Narac G studies are examples.

Has the Navy done any such total fleet studies to evaluate the cost and combat effectiveness of a V/STOL Navy as opposed to a conventional aircraft Navy?

Admiral TURNER. No, sir; we have not.

Mr. CROMWELL. When will such studies be done? Will they be done before the Navy begins committing a large expenditure of funds to the V/STOL program?

Admiral TURNER. There are studies under way at this point but, again, we are starting from a requirement to maintain the 12 carrier

Digitized by Google

decks and the 12 airwings. Our option, it seems to me, is to try to maintain the force levels with conventional takeoff and landing aircraft while at the same time examining the possibilities of vertical takeoff and landing aircraft.

It seems to us there is enough time to do this with all deliberate speed, to investigate all technologies with payoffs in either area, with ample opportunity to review the matter at well-defined decision points, and to proceed as the information and the technology beckons.

If V/STOL proves effective, then I think we have the potential to accomplish more functions in one aircraft and as a very decided benefit and corollary, be able to disperse and operate these aircraft from platforms, other than aircraft carriers.

We are studying it. There is a whole new future out there, and I think it is going to be occupying the times and lives of these gentlemen here in this room and yourself as well.

Mr. CROMWELL. I appreciate that you are doing the studies. But it raises a few flags of caution, I think. A lot of people tend to look on V/STOL as a panacea for the Navy and yet I don't believe they have looked at the total requirements as you have talked about them today; how you operate an air wing in a combat environment, what your needs are. You have been very articulate on it.

It raises some questions to me. If you are going to start replacing 43,000 pound S-3 ASW airplanes with 50,000 pound V/STOL airplanes with a similar capability, I begin to wonder, are you going in the right direction. I don't say this to be critical, but I do hope that the studies will take a good, careful look at the future of the Navy and whether or not its total combat capability will or will not be degraded if the ships are made for V/STOL.

This question was raised in the early draft of the National Security Council study on Navy carriers, whether the total fleet vulnerability might not be greater—in other words poorer or more vulnerable—with two small carriers versus one large carrier.

The same thing might apply to this total V/STOL question. Will these studies be aimed at answering that kind of question?

Admiral TURNER. Absolutely. And if the studies don't answer the military requirements and don't give us the evidence that we are on the right track to maintain our capabilities, then I will recommend strongly that we not proceed any further.

Hopefully, they will indicate that there are possibilities and we might be able to produce the smaller sizes and in fact, we might be able to even do better overall by going this particular propulsive and aerodynamic route—V/STOL.

Mr. CROMWELL. Admiral Petersen?

RISK FACTORS

Admiral PETERSEN. I would just like to add one comment. The 50,000 some pound airplane was based on some relatively conservative approaches. When we say it is high risk, that risk assessment in toto is based on a considerably lighter aircraft than that.

If we were to accept a 50,000 to 60,000 pound airplane, then the risks involved in this development would be considerably less than Captain Dapogny described to you.

Mr. CROMWELL. Thank you, Admiral.

Digitized by Google

I have more questions on V/STOL for the record. Also there are more on the Sixth Fleet operations and on your force structure presentation. I am sorry we ran out of time, and I apologize for the disjointed nature of today's hearing, but at least we got through it.

The additional statements will be inserted in the hearing record at this point.

[The following presentations and questions were submitted for the record:]

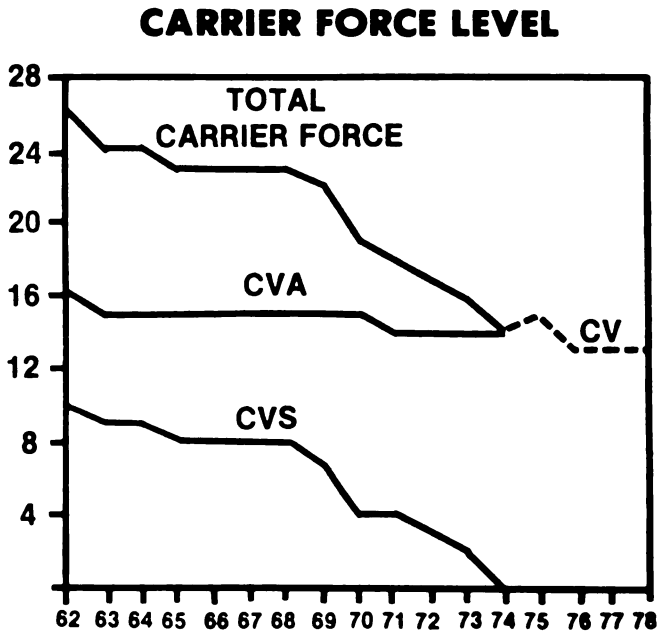
WAR AT SEA—"ALPHA STRIKE"

Admiral Turner has described the fleet scenario, of war at sea, and I will cover a much smaller but very important aspect of war at sea—a coordinated air strike, where the best capabilities of each aircraft or weapon are used in harmony to support or enhance the total effort. Variations of this tactical application of force goes back to the sea battles of coral sea, and midway, where the concert of fighters, dive-bombers, and torpedo planes destroyed or turned back the Japanese fleet 35 years ago. Such large coordinated applications of sea based air power have come to be known as an "Alpha Strike."

[Deleted.]

CARRIER AVIATION FORCE STRUCTURE

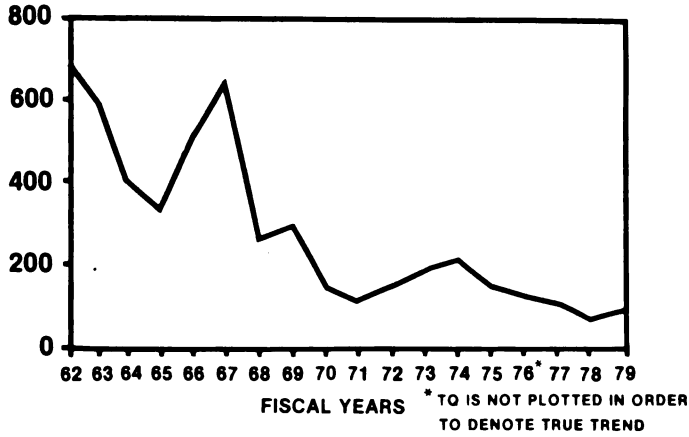
I will now review our carrier aviation force structure. Since aircraft force levels are tied quite closely to the number of carriers in the fleet, it would be appropriate for us to start with a few thoughts on our multi-purpose carrier force—for the FYDP years and beyond.



But first, in order to fully appreciate where we are going, it is useful to take a brief look at where we have been. Since 1962—pre-Vietnam era—our carrier forces have steadily declined in numbers, to the point where in the FYDP years, we will have half the carriers and carrier air wings that we had fifteen years ago. Without question, our nuclear powered nimitz carriers are vastly more capable than their predecessors. But as you can well appreciate there is much to be said for adequate numbers, both as a peacetime deterrent and as a fighting force.

Digitized by Google

DON CARRIER AIRCRAFT PROCUREMENT



Our procurement of aircraft has also been sharply reduced over the years. In 1962, we procured 684 carrier-type aircraft as opposed to 74 requested in the fiscal year 1978 budget. While we must acknowledge that both the cost and capability of carriers and aircraft have risen sharply, so has the threat, in Kiev carriers, Kresta and Kara cruisers, Backfire bombers and cruise missile launching nuclear submarines.

CV AIR WING

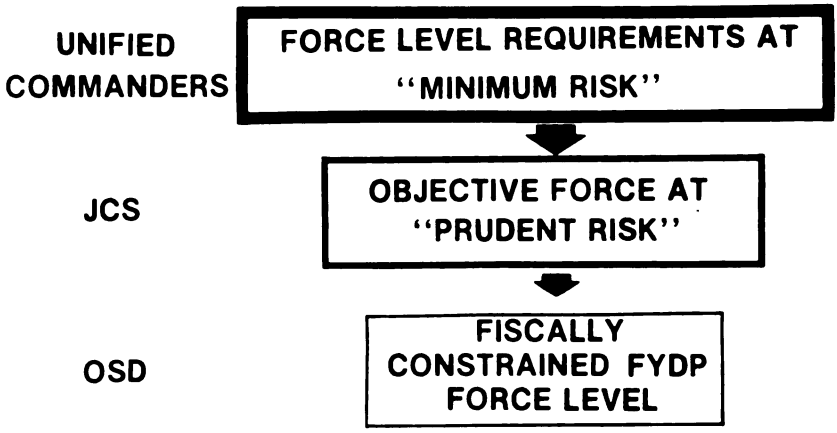
FIGHTER (F-14/F-4)	24
LIGHT ATTACK (A-7)	24
MED ATTACK (A-6)	10 (12)
TANKER (KA-6)	4
RECCE (RA-5/RF-8/RF-14)	3
AIR EARLY WARN (E-2C)	4
ELEC WARFARE (EA-6B)	3
ANTI-SUBMARINE (S-3A)	10
ANTI-SUB HELO (SH-3H)	8 (6)

As you know, our carrier air wings are designed for one purpose—to conduct sustained combat operations at sea in the execution of the national strategy. Each type of aircraft in the air wing has a specific function designed in the aggregate to defeat the enemy: the E-2C and the F-14, with its phoenix missile system teamup to shoot down aircraft and anti-ship missiles—whether they be launched from submarines, surface ships or "bomber" type aircraft, the A-7E and A-6E aircraft search for and destroy surface warships at sea and conduct long range strikes against enemy naval installations; the fighters escort them; the KA-6D tankers provide the extra fuel for extended range or time; the S-3A and SH-3H locate and sink submarines; the EA-6B jammers blind enemy radars, and reconnaissance aircraft support all these tasks. Since the enemy

Digitized by Google

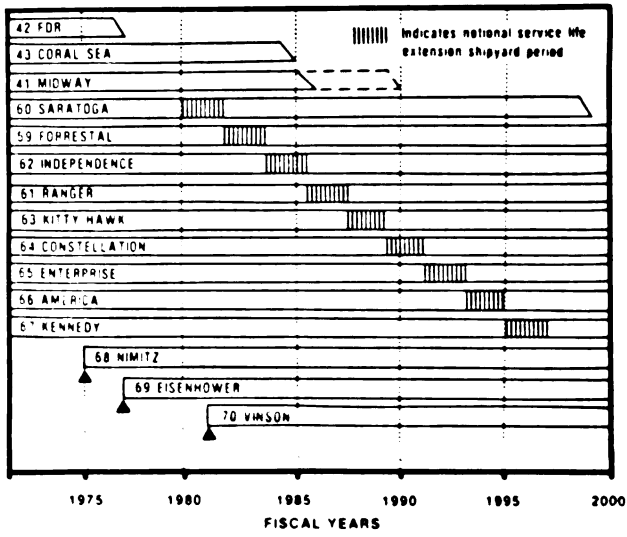
at sea is able to mount a coordinated multi-threat attack from all quadrants in any weather, our carrier air wing is prepared to engage and defeat that enemy with a 360 degree, 24 hour, all-weather offensive capability.

DERIVATION OF CARRIER FORCE LEVELS



Now to the carrier program, the unified commanders are annually required to submit to the joint cihefs of staff their force level requirements for aircraft carriers at various levels of confict. A "*minimum* level of risk" is specified. The JCS then determined what forces are needed at a "prudent" level of risk. The result is the objective force level. Suffice it to say that the "minimum" risk force level is not attainable with our present shipbuilding capacity. But the JCS objective force for 1986, that is the prudent risk force, is [deleted] multi-purpose carriers and *is* attainable. It is the *budgetary* constraint which now limits us to a force of twelve regularly deployable multi-purpose carriers and air wings for the FYDP years and into the mid-eighties.

NAVY CARRIER PROGRAM



Digitized by Google

In order to maintain our carrier force the Navy has a two-pronged plan featuring extension of existing ships where feasible and new construction. The first part of the plan is a carrier service life extension program—or "SLEP". This program is expected to extend the useful service life of our four (4) *Forrestal* and four (4) *Kitty Hawk* Class Carriers from 30 years to 45 years. It is planned that the first ship would enter SLEP in 1980 for a period of approximately 28 months and undergo repairs to the hull, machinery and electrical components as required to provide assurance of 45 years of reliable steaming. The program will be phased so that only one carrier is undergoing SLEP at any time.

With regard to new construction, the Secretary of Defense has directed that a program be developed to replace the oldest large deck carriers with conventionally powered medium size carriers on a greater than one for one basis. This new design carrier will be a ship able to accommodate our current and planned inventory of conventional take-off and landing type aircraft as well as V/STOL aircraft when that technology reaches fruition, as will all current big deck carriers. The next speaker, Captain Dunleavy, will address the V/STOL program in detail.

We have shown you the standard configuration of our air wings and discussed carrier force levels for the FYDP years and beyond. I would now like to review each of the major aircraft programs that equip our carrier air wings.

Fighter program

The F–14 Tomcat has continued to perform very well in the operational environment. It has proven itself in the fleet air superiority role where its long range radar and near-simultaneous long-range missile launch capability is unequalled by any other aircraft in the world. It is also an outstanding close-in "dog-fighter." To date we have forwarded-deployed F–14 squadrons five times—twice each aboard *Enterprise* and *Kennedy*, once aboard *America*. We are scheduled to deploy [deleted] more squadrons this yaer aboard *Constellation*, *Kitty Hawk* and *Nimiz*. The recent *America* cruise showed a significant improvement in F–14 material readiness over the initial deployment, although still not up to CNO standards. The two squadrons of air wing six had a [deleted] material ready rate. This compares with the previous [deleted] material ready rate. We know we can do better and are placing proper emphasis on necessary hardware improvements for the airframe and engine. More recent results on *J. F. Kennedy* show a [deleted] plus percent material readiness rate, while for a small group of aircraft engaged in a missile evaluation, the material ready rate is running at or above 70 percent, the CNO standard. We are getting there in the important area of material readiness.

NAVY FIGHTER PROGRAM

AIRCRAFT	SQDN UE	78	79	80	81	82
F-4N/J/S	12	10	8	8	6	4
F-14A	12	14	16	16	18	20
TOTAL SQUADRONS		24	24	24	24	24
PROCUREMENT						
F-14 (521)		44	60	60	42	-
CILOP	228 F4B F4N					
	260 F4J F4S					

Our procurement profile for the F–14 has been changed significantly. In order to achieve a more cost effective and production efficient procurement, we are now requesting 44 F–14 aircraft in fiscal year 1978, 60 each in fiscal years 1979 and 1980, and 42 in fiscal year 1981. This results in an additional 118 F–14 aircraft which will be procured through fiscal year 1981. The total buy for all years will be 521 aircraft. A major factor in this revised procurement profile is the decision to use the F–14 as an interim reconnaissance platform to replace our RA–5 and RF–8 aircraft. The reconnaissance inventory will utilize [deleted] F–14s in the period 1980 through 1984. More on that subject a little later. The acceler-

Digitized by Google

ated procurement will also enable us to maintain [deleted] F–14 squadrons for a period of 3 years commencing in 1982. Eventually, attrition of the total F–14 inventory will require transition of [deleted] of these squadrons to the F–18 in 1985.

An additional benefit to this early buy-out is realized in the F–4 program where the average age of the Navy-Marine Corps incentory is [deleted] years. The advanced buy will enable us to retire 40 F–4Js and lower the average age of our fighter force. We have been updating our F–4 forces since 1972 by converting F–4Bs to the F–4N and converting F–4Js to the F–48. This conversion in lieu of procurement is in essence doing more with less. In addition to improving the weapons systems and airframes of these aircraft, we have been able to extend their service life by [deleted] years.

As you can see, we will be down to four Navy F–4 squadrons in fiscal year 1982. These aircraft will be replaced by the F–18 in fiscal year 1948.

NAVY F/A -18 PROGRAM

PROCUREMENT

AIRCRAFT	FY 79	80	81	82	83	84
F/A-18 (800)	9	30	72	120	132	132

Although the F–18 does not show up in the Navy force levels for the FYDP years, I would like to speak briefly about our progress to date in that procurement effort. The F–18 will be a single place, twin engine multi-mission aircraft. Two versions of the F–18, a fighter and an attack version, will be developed with common airframes and engines. The procurement plan has been adjusted in the first year, 1979, to a low production rate of nine aircraft in order to reduce concurrency. The 1980 procurement will be 30 aircraft, and the rate then increases in the following years to a maximum of 132 aircraft per year. Initial deliveries of the fighter version will be to the marines in 1981. The first Navy F–18 squadron will be formed in 1983.

Attack program

We have had some changes in our attack aircraft programs since last year's presentation—primarily in the decsion to terminate A–7E procurement with the fiscal year 1977 buy. The substitution of the F–14 as an interim reconnaissance platform, and the planned introduction of the A–18 were factors in this decision.

NAVY ATTACK PROGRAM

AIRCRAFT	SQDN UE	78	79	80	81	82
A-7A/B/C/E	12	24	24	24	24	24
A-6E	10(12)	12	12	12	12	12
TOTAL SQUADRONS		36	36	36	36	36

PROCUREMENT

A-7E (578)	-	-	-	-	-
A-6E (138)	12	15	12	-	-

CILOP 228 A6A A6E

The A–18 program is on track with no major problems. It will provide the necessary replacements for the A–7E commencing in fiscal year 1984.

Digitized by Google

We intend to continue procurement of the A–6E Intruder for three additional years in the FYDP. Because of previously insufficient procurement in this area, we have accepted reduced outfitting of our maximum attack squadrons in fiscal years [deleted]. The UE or unit equipment previously approved was 12 aircraft per squadron. It will be temporarily dropped to [deleted] per squadron. But by 1979 we will be equipped at the proper level. All new procurement A–6s will be configured with a greatly improved sensor suit called TRAM—target recognition attack multisensor. The TRAM system provides the A–6E with the unique capability to passively acquire, identify and attack known targets—especially seaborne targets—at night and under limited visibility conditions, on the first pass, with laser or electro-optical guided weapons as well as conventional weapons. The TRAM modification includes forward looking infrared, a laser ranger and designator, and a laser receiver. Some A–6Es will also be equipped with the harpoon missile when that weapon joins the carrier force in [deleted].

While we have increased procurement of new A–6E aircraft, we also continue conversion in lieu of procurement—of A–6As to A–6Es. This program will give us an all A–6E force in fiscal year 1978. It also provides sufficient A–6 airframes for conversion to KA–6Ds in order to maintain tanker force levels at four per airwing.

Electronic countermeasures program

The EA–6B Prowler has proven to be an effective addition to the carrier air wing. Its employment of active electromagnetic radiations to suppress and degrade enemy radar and communications nets is complemented by its capable passive sensors in certain tactical situations. It is undoubtedly the most capable aircraft of its kind in the free world inventory and is frequently utilized by other services to test new airborne systems and tactics. The procurement shown has not changed since last year's hearings by this committee. Introduction of the EA–6B into the Marine Corps, which was approved last year, is on schedule. The first Marine Corps aircraft will be delivered this month. The total program of 90 aircraft will support 36 EA–6B's for Navy fleet squadrons, 15 for the Marine air wings and 9 for the training squadron.

NAVY TACTICAL ELECTRONIC COUNTERMEASURES PROGRAM

AIRCRAFT	SQDN UE	78	79	80	81	82
EA-6B	4 (3)	9	11	12	12	12
PROCUREMENT						
EA-6B (90)		6	6	6	-	

The proliferation of threat systems at sea and the continually growing importance and sophistication of electronic warfare has led us to a redefinition of EA–6B tasks, and to an acknowledgment that we need to maintain the unit equipment at four per squadron. This is necessary if we are to perform the mission in an extended combat operation. The FYDP will only support a UE of [deleted] as we increase the number of EA–6B squadrons to one per air wing by 1980. We are presently reviewing several procurement alternatives to satisfy that requirement. These alternatives will be weighed against our total aircraft procurement plan and are being considered at this time in the planning programing process.

Reconnaissance program

In our tactical reconnaissance program, we plan to retire—finally—our RF–8's and RA–5's in fiscal year [deleted]. I have already discussed briefly our increased

38-370 O - 77 - 36

Digitized by Google

F–14 procurement and the temporary use of [deleted] F–14's as interim reconnaissance aircraft. The Tactical Air Reconnaissance Pod System—TARPS—will provide the sensor for use on the F–14. But eventual demands for those aircraft in the fighter force will require their replacement by 1985 when we expect to have a version of the F–18 to assume the reconnaissance role. In the interim, the RF–14 UE will be [deleted] per air wing.

Airborne early warning program

The E–2C is the other element of the team which, together with the F–14, has produced significant advances in our fleet air superiority mission. Additional missions for the E–2C include surface surveillance, strike control and ASW coordination. The Hawkeye utilizes both active and passive sensors, integrated by a central computer to provide threat warning and analysis of the tactical picture—air surface and subsurface—to the task force or fleet commander. Beginning with fiscal year 1976 procurement, the E–2C has been modified with the Advanced Radar Processing System (ARPS) which provides a significant increase in the radar's anti-jam capability, automatic overland detection and tracking, and increased small target detection ranges. The earlier production E–2C's will be retrofitted with ARPS commencing in fiscal year 1979.

As presented last year, our objective is an all E–2C force of four per squadron. To achieve that in 1983, we will continue procurement at the rate of six aircraft per year as previously planned. But we will need an increase in the total program, from 67 to 85. Only with this extended procurement will we be able to replace the much less capable E–2B in our fleet squadrons.

Carrier ASW program

The S–3A Viking is a carrier-based submarine killing search and attack aircraft developed to exploit the latest technology in ASW systems. It extends our ASW capability into the deep oceans outside the range of land based aircraft. It is capable of employing the standard anti-submarine weapons such as homing torpedoes, conventional and nuclear depth charges, rockets, and mines. Its endurance qualities and excellent radar, forward looking infrared, and electronic search equipments provide an effective surveillance capability to the force commander.

NAVY CARRIER BASED ASW PROGRAM

AIRCRAFT	SQDN UE	78	79	80	81	82
S-3	10	11	11	11	12	12
SH-3*	6	11	11	11	12	12

*PLUS PLANE GUARD DETS ON CVs WITHOUT ASW HELO SQDN ABOARD

PROCUREMENT

S-3 (187) PROCUREMENT COMPLETED IN FY-76

SH-3 CILOP 137 SH-3A/G SH-3H

The S–3A program will complete delivery of the current procurement in March of next year. Transition of the eleventh squadron is nearing completion and the recent sailing of *Kennedy* marks the fifth deployment of S–3 squadrons in our CV's. S–3A material readiness continues an upward trend typical of a maturing weapons system.

Our ASW helicopter squadrons round out our balanced and highly effective carrier air wings. They are equipped with the SH–3 Sea King. This aircraft is an essential weapon system for the close-in detection and attack against enemy submarines. We are continuing a CILOP program—conversion in lieu of procurement—which will upgrade our older SH–3's to the more capable

Digitized by Google

SH–3H version. This conversion program adds a sonobuoy capability with onboard acoustic processing, a magnetic anomaly detector, and an improved variable depth sonar. In total, these additional systems yield an aircraft with increased capabilities for finding and destroying submarines. The SH–3 CILOP program will be completed in 1979. Commencing in fiscal year 1978, the SH–3 squadron UE will be reduced from eight to six aircraft.

SUMMARY

I would like to summarize this presentation by saying that half of our carrier air wings now possess the most modern of these aircraft I have reviewed with you today. The others are slowly being modernized. Those wings, and the ships from which they fly are a major part of the Navy's balanced force. They possess unique capabilities and power at sea available to support our national strategy and can do so on a worldwide basis. By no means do we face a task of rebuilding naval carrier aviation. We need only to add incrementally to that which is already in being and which we assure you performs so well. You gentlemen have helped to make it that way and I hope together we will continue the process which has produced such a capable and flexible power for peace.

AIR WING COMBAT TRAINING

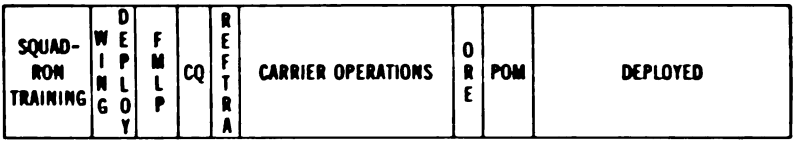
Gentlemen, I am going to briefly cover the way in which the Navy manages the training of its carrier air wings. In considering this subject, it is important to recognize that it is only part of the larger process of preparing the carrier for the performance of its mission. Air wing training must be harmonized and ultimately blended into the total training process by which the carrier and its crew are made combat ready. This requirement, more than any other, tends to dictate the sequence and timing of training especially in the latter stages of the process. I intend, in the time available, to focus on these latter stages, describing for you how the individual crew is progressively trained as a member of the ship/airwing team. In the process I will also describe the training facilities required for this training and the way in which they are used. Finally, I will briefly discuss some developmental efforts which promise to improve our capability to conduct combat aircrew training.

Let me begin by describing the complete training continuum to which our aircrews are exposed. For the new pilot or NFO this begins in undergraduate training where the student is provided with basic airmanship skills and introduced to elementary tactics. The future TACAIR pilot receives a total of 250 hours of undergraduate flight training while the student NFO receives 70 to 90 hours. The undergraduate syllabus takes about a year to to complete.

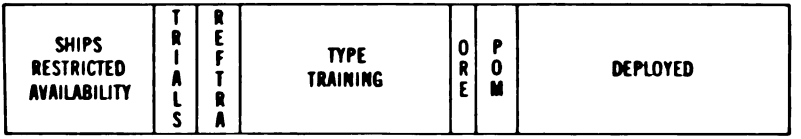
From undergraduate training the newly designated pilot or NFO reports to one of 13 fleet readiness squadrons for weapon system specific training. At this point he is joined by the experienced aviator who is returning to squadron duty. The fleet readiness squadron provides between 70 and 100 hours of flight time. Training times range from four to six months depending on the type aircraft and experience level of the pilot or NFO. The aircrew completing the fleet readiness squadron syllabus is proficient in the operation of the weapon system, they have been exposed to the basic tactics for its employment, and they are day and night carrier qualified. They are about 85 percent combat ready as they report to the fleet squadron. The remaining 15 percent of readiness is acquired in the squadron and airwing training programs which are designed to integrate the aircrew into the ship/airwing team. It should be stressed that the 15 percent figure is an output measure. The resource input in time, flight hours, and overall effort required to achieve this last increment of readiness is relatively high. The aircrew must now learn to operate as part of a multiple aircraft team with aircraft of differing types over a broad spectrum of missions. They must learn to provide support to other weapon systems and in turn to use support from those systems; and they must learn to do this with the timing and precision which are demanded in carrier operations.

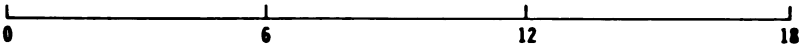
Digitized by Google

AIR WING TRAINING CYCLE



CARRIER TRAINING CYCLE





The carrier air wing training cycle depends on the deployment cycle of the carrier. The nominal carrier cycle is 18 months long. It begins with a ships restricted availability (SRA) which typically takes about three months. This is a short shipyard period during which preventative maintenance, repair, and some modification to hull and machinery are accomplished. During this three-month period the bulk of the personnel turnover for the cycle occurs. When the ship puts to sea after SRA, between a quarter and a third of the crew will be new to the ship. Following the shipyard period the ship will spend a month in local sea trials and then proceed to refresher training under the direction of the fleet training group. Between refresher training and deployment, the carrier will have two or three type training periods under type commander supervision. The ship will also participate in fleet exercises conducted by the Second or Third fleet Commanders. Finally, at the end of the period, the carrier and airwing will undergo an operational readiness evaluation. At this point the type commander must certify that the ship is ready for deployment. This is followed by a short period of preparation for overseas movement and deployment to the Sixth or Seventh Fleet.

The airwing training cycle must match the ship's schedule. As the ship begins the cycle the squadrons are at their home bases. During the first two or three months of the cycle they also experience a heavy personnel turnover. Aircrew training during this period is primarily conducted at the squadron level as the old hands renew qualifications that have expired during deployment and the newly reporting aircrews are integrated into the squadron tactical organization. However, this training progressively moves toward intersquadron operations involving the various types of wing aircraft. Thus, the fighter and attack aircraft begin to work together; and the airborne early warning squadron and electronic warfare squadron provide services to the other squadrons in the wing. This process culminates with a weapons training deployment of the full airwing during which the parts are all put together for the first time. It is here that the full range of capabilities of the airwing are exercised together. The tactics for maneuvering large formations, the proper use of organic airborne early warning aircraft to control wing exercises and the integration of organic electronic warfare assets into the tactical scheme are all addressed during this phase of training. These tactics, which were exemplified in the Alpha strike briefing previously presented, involve skills which are fundamental to the whole range of potential carrier air wing missions against targets at sea and on land. The goal is to mold the separate squadrons of the wing into a single well coordinated fighting unit.

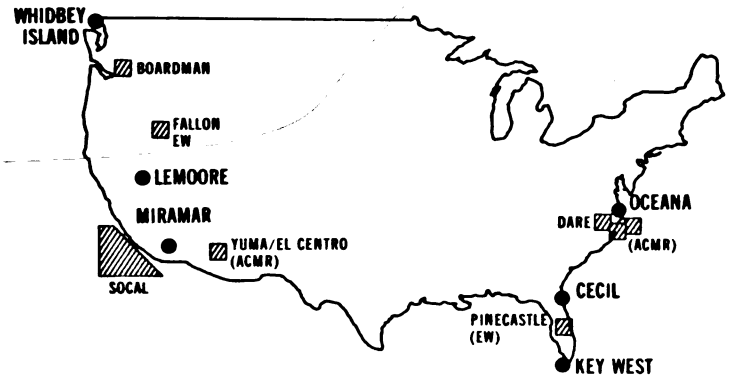
About a month after the weapons deployment the wing rejoins its ship during the refresher training period. After carrier qualifying as a unit, the wing will conform to the carrier operating schedule for the remainder of the turnaround

Digitized by Google

period. The squadrons will alternate between shipboard operations and their home base, working to maintain individual aircrew proficiency and complete the process of integrating their operations into a coherent ship/airwing whole.

It is significant that the time available for airwing training during the carrier turnaround has remained essentially unchanged for the past twenty years. Yet twenty years ago a carrier airwing had three or four different aircraft; today there are between seven and nine. Twenty years ago the carrier was largely a day VFR weapon system employing guns, iron bombs and free rockets; today we deploy a true all-weather capability with a variety of guided and unguided weapons. There has been an order of magnitude increase in both capability and diversity of mission in that time. Obviously, the training problem for the airwing commander has been greatly compounded. Yet he is required to get the airwing ready to deploy in the same period of time. That this can be done is principally due to two factors—the fleet readiness squadron and the training facilities available to us at each of our major bases. I would like to briefly discuss each of these.

TACAIR BASES



TARGETS AND RANGES

The map shows the location of the Navy's principal fleet naval air stations: The home bases of our fleet squadrons. Our fleet readiness squadrons are colocated by type with the fleet squadrons. Thus the Atlantic fleet fighter squadrons and the Atlantic fleet readiness squadron for fighter aircraft are located at Oceana, Virginia near Norfolk. Similarly, Pacific fleet fighters are at Miramar, near San Diego. East and west coast light attack squadrons are at Cecil Field, near Jacksonville and Lemoore, California; medium attack squadrons are at Ocean and Whidbey Island, Washington; airborne early warning squadrons are at Norfolk and Miramar. Our reconnaissance squadrons are located at Key West and Miramar; while our carrier electronic warfare squadrons are all at Whidbey Island.

The fleet readiness squadron performs the obvious function of providing the squadron and wing commander with well qualified aircrews. These crews are much further up on the learning curve than was the case twenty years ago. Perhaps not so obvious is the reservoir of expertise residing in the readiness squadron which is available to the fleet squadron during its training cycle. The readiness squadron provides support services in the form of instructor talent, simulator time, and standardization checks in instruments and systems operation. All of these services facilitate the process of achieving full airwing readiness.

We are also fortunate in having good weapons training facilities associated with each of our major fleet naval air stations. These are also shown on the chart. I will briefly describe these range facilities and their use.

Squadrons at NAS Oceana have available air to ground targets in the Dare County complex in North Carolina which provide impact scoring for practice bombs, rockets and strafing. Additionally, airspace is available off the North

Digitized by Google

Carolina coast for air-to-air work. A recent addition to this complex is an air combat maneuvering range which is located just east of Kitty Hawk over the ocean.

The air combat maneuvering range provides the capability to track and record the position and velocity vectors of multiple maneuvering aircraft in real time. It can also sense simulated weapons firing and apply the appropriate ballistics to determine whether a hit would have been achieved. In short, it makes possible the creation of a detailed record of a multiple aircraft air-to-air engagment and allows post flight assessment and debrief of tactics and weapons utilization. It is an extremely powerful training tool which promises a quantum improvement in the skill and proficiency of our fighter aircrews. I will discuss some other potential uses of this range in a few moments.

Squadrons at Cecil Field have available targets in the Pinecastle complex just to the south in the Ocala National Forest. This complex contains a number of air-to-ground targets with scoring capability for practice ordnance.

The Pinecastle Target Complex is, also equipped with an electronic warfare range. This range provides a variety of simulated threat emitters covering a variety of anti-aircraft and surface-to-air missile radars. Aircraft operating on the range are thus able to exercise defensive electronic countermeasures equipment and realistically employ the appropriate defensive tactics. The range has a record and debrief capability which permits post flight evaluation of tactics employed.

Our west coast based squadrons have available facilities which are almost identical in type and relative location to those available to east coast squadrons. The Yuma-El Centro Complex and the southern California operating area support Miramar based fighter squadrons; the Fallon, Nevada Complex supports Lemoore based attack squadrons; and the Boardman, Oregon Complex supports Whidbey Island based squadrons.

The facilities just described are used by the airwing both when based ashore, and when operating from the carrier in coastal waters. When deployed on fleet exercises or type training to the Caribbean, Atlantic fleet airwings have available the facilities of the Atlantic fleet weapons range located at the eastern end of the island of Puerto Rico. This provides basic air-to-air and air-to-ground facilities equivalent to those found in CONUS.

Pacific fleet airwings operating in Hawaiian waters have available a similar capability in the Kahoolawe Island target area and the various over water air-to-air operating areas at the western end of the Hawaiian chain.

The range complexes that have just been described are an extremely valuable set of training assets. Recent efforts to upgrade the training capability have resulted in a significant investment in range hardware.

ATLANTIC FLEET TRAINING RANGES
(AREAS OR TARGETS)

RANGE	INVESTMENT (IN THOUSANDS)	O+MN
PINECASTLE ELECTRONIC WARFARE RANGE, FLORIDA	$ 31,000	$ 171.1
VIRGINIA CAPES OPERATING AREA, ACMR	$ 22,650	$ 1,300
ATLANTIC FLEET WEAPONS TRAINING FACILITY	$ 53,585	$ 844.8

Digitized by Google

For the Atlantic fleet these investment costs are shown here. Additionally, the introduction of these sophisticated systems has entailed an increase in operating and maintenance costs. These O&MN costs for fiscal year 1977 are also shown.

PACIFIC FLEET TRAINING RANGES
(AREAS OR TARGETS)

RANGE	INVESTMENT	O+MN
	(IN THOUSANDS)	
NAS FALLON, NEVADA (EW RANGE)	$ 41,618	$ 232
NAVAL WEAPONS SYSTEMS TRAINING FACILITY, BOARDMAN, OREGON	$ 1,442	$ 375.7
SOUTHERN CALIFORNIA OPERATING AREA	$ 30,700	$ 748
MCAS YUMA, ARIZONA, ACMR	$ 21, 292	$1,615

Similar costs have been incurred in upgrading and supporting our west coast training ranges.

Overall, these facilities represent an investment cost; exclusive of real estate of 202 million dollars and annual operating costs of 5.3 million dollars.

The process that has just been described is effective in preparing our carrier airwings for deployments. It takes a group of individual aircrews with a basic weapon system qualification and, in a logical training progression, creates a functioning ship/airwing team.

PROBLEMS

- TRAINING TIME
- MAINTAINING PROFICIENCY WHILE DEPLOYED

While the concepts are simply stated, I would not leave you with the impression that there are no problems. We do perceive two major problem areas in connection with the training process, for which we are actively seeking solutions.

Our principal problem in the training process itself is time. Within a fixed time constraint the airwing commander is faced with a steady increase in weapon systems capability and concommitant diversification of tactics which

Digitized by Google

must be addressed somewhere in the training cycle. The problem is compounded as more sophisticated weapon systems require that increased time be devoted to maintaining individual crew proficiency and at the same time, increased attention must be devoted to more complex multiple aircraft tactics. This situation is further compounded by recent restrictions in operating funds which appear to be a fact of life for the future.

A second perceived problem is that of maintaining the proficiency gained during the pre-deployment training period throughout the subsequent deployment. Range facilities available to sixth and seventh fleet carriers are limited and lack the training capability which we have provided in our stateside ranges. Furthermore there has been a steady decline in the availability of ranges on foreign soil over the past few years.

POTENTIAL SOLUTIONS

- SIMULATION
- EXPANDED ACMR CAPABILITY
- AT-SEA ACMR

We feel that the answer to our training time problem lies in simulation, specifically, as we are able to place more of the flight hours and training time currently devoted to the maintenance of individual aircrew proficiency into ground based simulators, we can expect to divert the resources saved to training in the larger tactical problems which involve a multiplicity and diversity of aircraft and crews. To do this we feel that we must greatly improve our ability to simulate visual flight conditions in our simulators. We are directing a substantial development effort to this end.

We are very much impressed with the capability provided in the air combat maneuvering range for air-to-air weapons training. We are able to get better training than we have ever had before and at the same time reduce the expenditure of ordnance. We are now working to extend the ACMR capability to air-to-ground training. This appears to involve only a software change to the present system. If this effort is successful we can expect more efficient use of available training time, and a reduction in the requirement for live ordnance expenditures. This latter feature is especially attractive since in addition to the dollar savings implied there are important ecological considerations which are driving us to reduce our live ordnance expenditures.

Finally, in order to provide a solution to the problem of maintaining weapons proficiency while deployed we are in the process of developing an at-sea air combat maneuvering range. This concept, which will place the current land based hardware on our deploying ships, will allow us to take range capabilities, equivalent to those used during the training cycle, to the sixth and seventh fleets on deployment.

Gentlemen, I have very briefly described the process by which the navy trains it carrier air wings. The focus has been on aircrew training. This is of course only part of the training problem. While the aircrews are learning to operate their weapon system, the maintenance crews must learn to maintain them, the ordnance crews must learn to load their weapons and the whole process must be put together to function effectively within the time and space constraints imposed by the carrier at sea. As I said at the beginning of this presentation, the goal is an integrated ship/airwing team.

Digitized by Google

NAVY TOPGUN UPDATE

INTRODUCTION

Good morning gentlemen. I'm LCRD Monroe Smith, CO of Navy fighter weapons school (NFWS) known as topgun. I have over 2000 hours in the F–4 both as a NFO and as a pilot. I flew the F–14 with experimental squadron 4 (VX-4) on its first opeval flights in 1972 and made the first operational F–14 deployment aboard USS *Enterprise* in 1974. I have been with topgun since April 1976 and will be discussing our efforts of last year. Before I launch directly into topguns accomplishments over the last 12 months, I would like to briefly refresh everyone on our school's background.

In 1968, as a result of the preliminary Ault report, Topgun was established in September and graduated the first official class in March 1969. Topgun was commissioned as a command in July 1972 and, as of January 1, 1977, we have graduated: 438 flight crews, 390 ground school only students, and 62 air intercept controllers.

Here's how we started in 1968 with a small trailer, 8 students and one flight instructor.

And now, we occupy the south east corner of hangar 2 at NAS Miramar, California; in addition to the 16 specialized instructors we have 5 F–5E's, 3 A–4E's, 1 TA–4J and 3 ancient, T–38's. In the background you can see the small trailer that we started with. We use that as a visiting detachment maintenance space. Believe me, we stretch our assets! Perhaps we overdo this.

Our responsibilities include:

a. The basic topgun course which is 5 weeks in length;

b. Providing adversary training for the fleet;

c. Teach adversary pilots from other commands;

d. Provide adversary to the F–4 and F–14 replacement training squadrons; and

e. Working with airwings deployed on carriers off the southern California coast during their operational readiness exercises.

The basic precepts of topgun are simply these:

Fight realistic adversaries that are flown by expert fighter pilots; then, be thoroughly and expertly debriefed so that if the time comes. . . .you can fight and win.

Accordingly to naval intelligence the MIG–21 is the primary threat that we could expect to encounter in a tactical war in the near future.

With exploitation and hands-on participation, we have proven that the F–5E closely simulates the MIG–21 in: (*a*) size, (*b*) performance, (*c*) flying qualities, (*d*) field of view from the cockpit, and (*e*) combat fuel package.

As far as physical size is concerned, the MIG–21/F–5E overlay graphically depicts the similarity of the two aircraft.

The F–5E has now proven to be extremely safe and cost effective in this environment. Actual costs are about $980/hour which includes fuel, contract maintenance, and parts. This makes it ideal for fleet adversary, and the fact that the F–5E is ACMR compatible adds significantly to its overall utility.

Our A–4E's are alive, but like the T–38's, they are slowly approaching the end of their useful service life. We returned one A–4E back to the Marine Corps; however, it was replaced with a TA–4J. Again, our OR rate is good and we extract about 1200 hours/YR from the skyhawks. I think it's significant to note that Topgun believes high performance models of the A–4 will continue to be suitable adversary aircraft for quite some time in the future. In particular, it lends well to the adversary units stationed at attack bases such as NAS Lemoore in California and NAS Cecil in Florida. If Topgun stays in the A–4 business, which I certainly hope we do, I anticipate replacing our E models with F models in the near future. After that I'm anxious to upgrade to the "Super F" version which has a larger engine and makes the A–4 "Scooter" a tough adversary.

The T–38 was not designed to withstand the rigors of the ACM environment. Even though we've placed a local 6 "G" limit on our T–38's and fly them with kid gloves, the OR rate recently slipped below 70 per cent. We are anxiously awaiting arrival of the new F–5F's in September of this year. I know we owe this committee a debt of gratitude for funding these aircraft. Topgun believes the Navy got its money's worth and we are expecting great things from the F–5F.

That's a thumb nail sketch of our background, I believe Topgun's effectiveness is a matter of record.

Digitized by Google

Last year our overall activity looked something like this:

(*a*) The basic course, which takes priority over everything else, was given 7 times and consumed 1100 hours.

(*b*) We had 16 adversary detachments with the Navy and Marine Corps totaling 2500 hours.

(*c*) We instructed 7 adversary pilot training courses which netted 400 hours to the fleet.

(*d*) And then the others combined gave us a grand total of 4500 flight hours.

Some additional statistics for 1976:

We graduated: 40 aircrews, 14 adversary pilots, 71 ground school grads, and 18 air intercept controllers.

In support of AIM/ACE VAL, Topgun flew over 650 sorties totaling about 700 hours. We were tasked with two separate objectives:

1. To prepare six F-14 aircrews for over land ACM against the maneuverable F-5E in multi-plane engagements.

2. To train 6 F-5E red force agressor pilots to fly adversary with the USAF during AIM/ACE VAL. Everyone had to be ready to go by 1 October 1976. All of this we did in addition to our normal tasking.

To support this effort, extensive utilization of the ACMR at MCAS Yuma was required during August and September. While this block diagram indicates the remote play-back capability at Miramar, the majority of our debriefings were on-site at Yuma.

Intercept geometry and parameters of "simulated kills" were evaluated to obtain maximum training and efficiency with minimum flight time. This evolution was successful.

Another extremely successful exercise that was implemented by Topgun last year was the 1 vs many ACM scenario. The largest one to date was held in July 1976 and boasted a total of 55 aircraft participating. We were pleased to have the USAF join us in this one. New concepts such as the 2 vs many (section against the world) and few vs many (like airplanes against the world) exercises were also implemented and evaluated as training exercises. We at Topgun are convinced of the value and safety inherent in this exercise. It has now also become a formal part of our Topgun syllabus. I believe this exercise, or some similar rendition could easily be flown from the deck of a deployed carrier. This would provide meaningful training to aircrews at sea, who must be prepared to maintain maritime air superiority.

We at Topgun understand the meaning of maritime air superiority. Being an exceptional fighter jock is not enough. Topgun recognized last year the relative void that existed in post graduate intercept training given the latest Soviet tactics, equipment and ECM employment. The answer? * * *

Topscope: What is it? It's a two week "bootstrap" course in post graduate radar intercept training. While embryonic in development, the course has been approved and supported up the chain of command all the way through CNO.

The first class was held 29 Nov 76 and had attendees from our own NFWS, and the other Pacific Fleet fighter squadrons. Here's the way the syllabus looks:

The Topscope syllabus now consists of about 50 hours of academics primarily oriented around definition of the threat and effective counter tactics. Of equal significance is the seven hours of simulator time dedicated to each aircraft. The use of simulators to replace actual flight time in the fighter community is indeed a volatile issue. While Topgun does not believe simulators fulfill the need for air combat training, the existing F-4 and F-14 intercept trainers at Miramar have proven to be of immeasurable value when instructing M.A.S. tactics. Multiple target raids complete with electronic countermeasures can easily be repeated a dozen times and thoroughly analyzed. As a matter of interest, new tactics were formulated during the conduct of the first Topscope course and have been submitted to Experimental Squadron 4 (VX-4) for further investigation and evaluation. Newly developed F-14 tactics were modified and applied to the F-4J. The result, some basic intercept capabilities were discovered for the Phantom in an ECM environment where previously none were thought to exist. Again, VX 4 has the responsibility for investigating the operational effectiveness of these tactics.

Basically, that summarizes our accomplishments to date. For the immediate future, we expect to continue expanding the topscope curriculum and forming a separate school at Miramar. Even now, the Navy is working on supplying the officer talent required to generate a successful school. With continued emphasis

Digitized by Google

on F–14 integration into the fleet, our mission at Topgun will reflect that level of post graduate training required to support fleet fighter aircrews in the air combat arena. From my position in the fighter community I have clearly seen continued improvement over the last four years in the average ability of fleet fighter pilots.

We in carrier aviation believe that our services will be required in a classic air strike of some description, albeit Alpha Strike, Enemy Stream Raid or some newer tactic will be flown over hostile territory, water or land—and the enemy fighters opposing such a strike will be omnipresent.

Given this exposure to hostile air activity in the target area it is the firm belief of Navy fighter aircrews that they will be heavily engaged in the air combat arena.

Thus the F–14, much like the Fokker tri plane and the Sopwith Camel, will be forced to survive in an environment that is predicated on pilot skill and aircrew training.

And that's what Topgun is all about.

Gentlemen, are there any questions?

QUESTIONS SUBMITTED BY SENATORS CHILES, HART, CANNON AND GOLDWATER

Senator CHILES. Last August, former Secretary Clements testified before our subcommittee that the Pentagon was proceeding to implement the new weapons acquisition policies called for in OMB Circular A–109 and that, in particular, the Navy's new V/STOL effort would comply.

Since then, Secretary Brown has also lent his support to the new policies and assured their implementation.

We understand that the Navy has prepared a new "Mission Element Need Statement" but that the V/STOL Request for Proposals does not allow complete freedom to explore alternatives, as required.

Can you again assure the committee that the new V/STOL effort will comply with the new acquisition policies?

Can you please reexamine the conditions imposed—or to be imposed—on the competition to be sure the Navy complies with the full intent to get wide technological exploration.

Captain DAPOGNY. Yes, Sir, Senator Chiles, you have our assurance that the V/STOL "A" program structure complies, and will continue to comply, with the acquisition policy of OMB Circular A–109. The Navy views competition as a basic and vital element in its efforts to ascertain both the viability and optimum utilization of V/STOL "A" and the proper manner of development. We have recently reexamined the conditions imposed on our present actions and the conditions we intend to impose on the impending competition, and we find them very well suited to our objective of obtaining wide technological exploration. It must be noted that our acquisition strategy is tentative and that it lacks details in some aspects, since it is heavily dependent on the results of our analysis of the forthcoming initial responses from industry. However, there are many points which we can state at this time which clearly indicate the scope, depth, and general nature of the Navy's approach to V/STOL.

The planned concept formulation phase of the V/STOL "A" program consists of four elements. First, the issuance of Request for Quotation for Information (RFQ/I). Second, a two-year Operational Concepts/Requirements Study. Third, a Request for Proposal (RFP) and conduct for conceptual studies. Fourth, an RFP for advanced development.

Subsequent to the SECDEF's approval of a mission need statement, the Navy entered into a formal dialogue with industry by releasing an RFQ/I to all interested offerors. The purpose of the RFQ/I is to enlist and marshall industry's technical expertise with regard to V/STOL weapon systems for use by the Government in formulating various missions and operational performance requirements, as well as to seek concept alternatives, trade-off studies and to receive comments on development strategy, critical technology areas, program risk and program cost estimates. The RFQ/I clearly and emphatically states the Navy's flexible approach. The program's success in meeting the extremely difficult objective depends on responses from industry which embody advanced concepts derived in an environment of wide attitude. In order to obtain

Digitized by Google

the maximum amount of industrial response at the system level (i.e., airframe, engine, and avionics system), the RFQ/I specifically requested responses at that level (rather than from a total system contractor—usually the airframe manufacturer). While this provides the most open environment to aircraft, engine, and avionics firms, joint responses were stated to be acceptable where desired by industry.

The RFQ/I requests for concepts and data were divided into three areas: a response to a partial, notional performance capabilities statement, designed solely for the purpose of obtaining data on contractor concepts in such a manner as to facilitate initial analysis and comparisons; a set of trade-off studies, to be augmented at the contractor's discretion, and a response completely unrestrained by any notional discussions on mission areas, mission equipment mixes, mission and aircraft capabilities discussed in the RFQ/—i.e., a system design based on their conceptual solution to the mission need and the established threat.

In the RFQ/I, in Navy FY-78 Congressional testimnoy, and in other public statements, the Navy has given clear indication of its open attitude toward the design nature and utilization of the V/STOL "A" by positions such as the following. The missions to be performed will not necessarily be segmented by aircraft variant as in the past, i.e., a primarily ASW aircraft may well be assigned some of the responsibility for attacking surface ships and for limited AEW, if technology and the new operational concepts warrant. This type of flexibility extends to the line of demarcation between the V/STOL "A" and the high performance V/STOL "B" fighter and attack aircraft—that distinction is being deliberately evolved in the new operational concept for V/STOL. In other critical aspects, initial views on ship-basing concepts range from varied operations off destroyers and future small high-speed ships to employment as convoy defense based on cargo carriers themselves, and in total air wing operations off CVNs and smaller carriers. There is under consideration the possibility of launching heavy, long range anti-air and anti-surface missiles from ship platforms for targeting and control by airborne V/STOL "A" aircraft as opposed to flying these off ships on either a V/STOL "A" or V/STOL "B" vehicle.

The method of evolving the operational concept and specific operational requirements is, in itself, indicative of the Navy's attitude toward desiring maximum technological analysis prior to firming specific concepts. Preliminary studies have given indications of the probable utility of V/STOL. However, a decision was made that the formulation of the actual operational concept and specific operational requirements would await the results of analysis of industry responses to the RFQ/I. An operational study team is being formed to use these results to produce the initial, tentative operational positions by late summer 1977. These will be incorporated in the RFP for industry studies for issuance in late 1977. This will provide industry with useful guidance, and contractors will still be accorded flexibility in their method of satisfying the problem. Two additional iterations between the evolving design concepts and operational concepts are planned prior to the final decisions in 1979. The extreme complexity and degree of difficulty of the V/STOL "A" situation precludes one-sided, premature determinations.

The RFQ/I and responses to it were specifically excluded from being considered in any forthcoming competition, to enhance the free flowing of initial ideas. In regard to the potential competition itself, the Navy has not yet determined the appropriate and necessary conditions to be imposed. As yet undetermined budgetary and technical constraints will, of course, have an effect. However, the general course of the Navy's intent is established by the above comments. In regard to the amount of competition, the Navy has stated a plan of having approximately nine major study contracts awarded. Further, the Navy's notional acquisition strategy for advanced development states that two aircraft concepts will compete through flyoff, and that two engines and various avionics efforts will be pursued.

While it is too early to be firm and specific, the general picture is clear. The program is being deliberately structured in clear phases and carefully milestoned. It is dictated by sound acquisition policy and complies fully with the OMB Circular A 109. A continuing review of the program will be exercised to insure that it does not deviate from the required principles.

Senator HART. In view of this ratio of Soviet anti-aircraft defense to U.S. attack aircraft, how realistic is our confidence in the ability of our naval aircraft to destroy the Soviet surface fleet in the Mediterranean?

Digitized by Google

Admiral TURNER. The ratio of SAM available to attack aircraft is not the only or complete survivability determinate. The availability to be launched and the cycle time for reload vs. the time the aircraft are exposed in the weapon envelope have to be considered. While not a direct comparison, our experiences in SEA and the Israeli-Arab conflict in 73 are experiences worthy of note. In SEA almost [deleted] SAMS per kill were recorded, and in 1973 the Arabs fired [deleted] Israeli aircraft. (They incidentally also shot down [deleted] aircraft). The Soviet ship SAM and gun defenses are impressive and in initial actions we would experience [deleted] but not to the degree that successful accomplishment of our mission would be infeasible or the losses unacceptably high.

Senator HART. What was the availability of your (*a*) F–4s; (*b*) A–7s during the October 1973 crisis? Given the availability rates, how many fighter aircraft did the 6th Fleet actually have during the 1973 crisis period? How many attack aircraft?

Admiral TURNER. The average operational ready rate for the fighter and attack aircraft aboard the three carriers deployed to 6th Fleet at the time of the crisis was as follows: (*a*) F–4s, 55.8 percent; (*b*) A–7s, 70.9 percent; and (*c*) A–6s, 51.5 percent.

Based on those figures we had an average of 37 fighter and 63 attack aircraft or 100 of the 163 aircraft of these types actually available for use at any time during the crisis.

Senator HART. What utility would you have found in a naval version of the AV–8B Harrier during the 1973 Mideast crisis?

Admiral TURNER. The AV–8B Harrier would have been a useful addition to our Task Force in that it would have been able to reduce our reaction time to preemptive aggressive action by its rapid launch capability (self-starting, noncatapult, lesser critical wind-over-the-deck requirement). Its smaller size may allow more aircraft per given deck, or at least less congestion and thus greater flexibility. We are gaining more and more AV–8A operational experience and examining ways to better utilize AV–8 capabilities. While minimizing its shortcomings.

Senator HART. Why could not a combination of F–4 and AV–8B aircraft serve the Navy's needs until the type A and type B V/STOL aircraft are available?

Admiral TURNER. The F–4 is capable, but rapidly aging aircraft, that does not have the air-to-air capability of the F–14, which is its principle replacement. Even if the basic aircraft had the capability of the F–14, the entire weapons system does not and a great many more F–4's would be required to counter a Soviet threat.

The AV–8B will be capable V/STOL and is in fact planned as the primary U.S. Marine Corps light attack aircraft and has application for sea basing on our carriers.

Senator HART. When weapons systems such as PHOENIX, MAVERICK and other standoff "smart" weapons are available, why is it necessary to carry these systems on high-capability aircraft?

Admiral TURNER. I believe it may be beneficial to explain our concept in employment of "smart" weapons. The intelligence of these weapons is related to their terminal accuracy once the target is acquired, identified as a valid target, and the weapon expended within its designed parameters. To use a "smart" weapon such as MAVERICK or PHOENIX requires an aircraft system with sufficient sophistication and capability to perform these essential functions. There is continuing debate within the Navy on the question of aircraft sophistication versus expendable weapon sophistication. A simplified aircraft weapon system could result in cost savings in aircraft procurement and maintenance costs, but at the expense of transferring additional capability to the expendable missile. Our approach is to minimize the cost of the throwaway item by incorporating only that amount of sophistication to insure good terminal kill probability. So called "smart" weapons are not inexpensive, and because of these costs, we do not foresee the ability to rely exclusively on their use. While they are invaluable in certain tactical situations, there is a wide spectrum of militarily significant targets which can be attacked and destroyed through the use of less sophisticated weapons. The use of these "dumb" weapons depends on accurate and capable delivery systems. Our system design approach is to minimize the cost of the expendable item by incorporating as much of the sophistication as possible into the reusable, more tactically flexible launch aircraft.

Senator CANNON. Given the capability of medium-performance aircraft, such as the AV–8B, when equipped with "smart" weapons, would not the Navy's net

Digitized by Google

position be better with these aircraft on large numbers of small V/STOL aircraft carriers, than with F–18s on a small number of large carriers?

Admiral TURNER. It is too early to submit a positive statement regarding the dispersal concept versus concentrated mass employment. The Navy is performing several operational analysis studies looking at various aspects of V/STOL. These studies are addressing how we would employ V/STOL, its effectiveness and how V/STOL and conventional forces compare.

Senator HART. How have our expectations of V/STOL performance and the availability of V/STOL aircraft changed since the F–18 program first began? At the inception of the F–18 program, what were the Navy's expectations of the date it would have available a V/STOL aircraft with the performance of the AV–8B? Of the projected Type A and Type B V/STOLS?

Admiral TURNER. Our expectations of V/STOL have *not* changed since the F–18 program first began. We have solicited inputs from industry relative to various design concepts which appear most achievable. The iterative studies and follow-on analysis subsequent to industry's inputs will more clearly illustrate attainable goals. The Navy is looking for a V/STOL "B" variant which will be high performance with increased capability over that of the AV–8B. The Navy envisions a subsonic, multi-mission, support Type "A" V/STOL aircraft entering fleet operations about 1991. A high-performance fighter/attack aircraft, Type "B" V/STOL, is envisioned around 1995.

Senator HART. Which program began first, the F–18 or the AV–8B? Please provide comparative schedules.

Admiral TURNER. The F–18 program began first. A comparative schedule for each is provided below:

	F–18	AV–8B
DSAR I (advanced development)	Not held	Mar. 26, 1976.
DSARC II (engineering development)	December 1975	May 1979.
DSARC III (production)	March 1980	March 1982.
Initial operational capability	September 1982	March 1984.

Senator HART. What studies have been done on alternatives to the F–18? Has any study been done of the AV–8B as an alternative? Have these studies just been comparisons of speeds, ranges, etc., or have they considered alternative ways of accomplishing mission?

Admiral TURNER. Extensive analysis was performed during the formulation of formulation of the requirements for the F–18, or VFAX as it was then designated. The primary studies were Navy Fighter Study IV and the Naval Tactical Aircraft Study. These studies addressed primarily the alternatives of versions of the F–14, an F–15N and a VFAX. After the requirements for the VFAX were established, Congress directed the Navy to limit the competition to only Navy versions of the USAF air combat fighter prototypes (YF–16/17). Subsequent to the selection of the F–18, no studies have been performed addressing alternatives to the F–18. The AV–8B was never investigated as an alternative.

Senator HART. Given the results of recent F–14 vs. AV–8A tests, which is projected to be the superior dogfighter, the F–18 or the AV–8B?

Admiral TURNER. Senator, there have been no "tests" between the F–14 and the AV–8A. On January 7, 1975, fleet F–14's fro USS ENTERPRISE did conduct some air combat training in the Philippines with AV–8A's flown by pilots from Marine Attack Squadron 513, but these engagements were strictly training flights and definitely were not "tests" or "evaluations." The training sorties were flown to familiarize the F–14 and AV–8A aircrews wtih the capabilities and limitations of the other aircraft in a close-in air combat maneuvering (ACM) environment and to ensure that the aircrews developed an appreciation for the different tactics that must be employed when engaging different types of aircraft. Such dissimilar aircraft ACM is conducted regularly throughout the fleet to enhance and improve the tactical performance of our fighter crews in air-to-air engagements. No definite results were expected from the training flights, and no conclusions as to the superiority of one aircraft over the other were sought or drawn. Since the AV–8B and F–18 do not yet exist in hardware form and no conclusions have been finalized realtive to the dogfighting capabilities of conventional take-off versus vertical/short take-off aircraft, it would be conjecture to state, at this time, whether the F–18 or AV–8B will be the superior dogfighter.

Digitized by Google

Senator CANNON. Are you describing current fleet tactics, as reflected in Fleet Tactics Manuals?

Admiral TURNER. The tactics described are based on TACTICAL MEMOS developed and utilized by today's Fleet carrier air wings. This particular strike tactic was generated by (1) the size and composition of the target threat, (2) typical assets available in today's carrier air wings. Current studies of the effect of tactics by weapon developments are on-going.

Senator CANNON. What PK on the Soviet force would be calculated based on this strike scenario and using the quantities of aircraft and weapons in the strike?

Admiral TURNER. No specific PK can be assigned, but operational assessment indicates that the missile firing capability of this selected enemy force would be greatly reduced and several ships would be severely damaged or sunk. Follow-on strikes would be necessary to completely neutralize the enemy force.

Senator CANNON. If the Navy had standoff weapons such as Harpoon and Condor available, would those be preferred for a first strike?

Admiral TURNER. Harpoon and Condor would be most welcome in conjunction with a first strike, since our forces will be forced to close within effective enemy defenses in order to accomplish their mission. "Softening" these defenses would reduce the probability of losses and increase the effectiveness of the attack.

Senator CANNON. What aircraft losses would be expected from this flyover attack?

Admiral TURNER. Depending upon the degree of readiness of the enemy forces (tactical surprise is a factor), our force losses are estimated to be 10–15 percent of the aircraft entering envelope of defenses.

Senator GOLDWATER. Admiral Turner, if a war had started back in that 1973 standoff, who would have won, your 6th fleet or the Soviets?

Admiral TURNER. I am confident that the Sixth Fleet could have carried out any of the missions assigned it at that time despite the presence or the intervention of the Soviets. Had a war started it would have been a bloody one, but our carrier air power and our highly effective ASW forces would have carried the day.

Senator GOLDWATER. How would you have preferred to operate your fleet, if freed of politically dictated directions on where and how to place your ships?

Admiral TURNER. It is my firm conviction that it is sufficient to assign a Fleet Commander the mission to be accomplished and leave it to him to arrange or place his forces in the disposition, locale, and readiness posture best calculated to optimize the situation in the national favor. In this particular case, the area of operations should have been larger, or better yet left undefined, thereby enhancing Fleet mobility and flexibility.

Senator GOLDWATER. The statement often is made that the 6th fleet would have to withdraw from the Eastern Mediterranean if a war crisis develops, out into the Western Med or the Atlantic, and then fight its way back in. Do you agree with that or what would you do as 6th Fleet Commander?

Admiral TURNER. The answer is highly dependent on the scenario. Sound tactics would dictate that operations be conducted from the best defensive and offensive position commensurate with the threat. In my four recent years in the 6th Fleet; however, I have not seen any situations that would force the Sixth Fleet to quit the Mediterranean.

Senator GOLDWATER. Would you rather start a war from a close-in posture or be disengaged?

Admiral TURNER. Naturally, I would rather not start any war at all—and with sufficient U.S. naval power I am persuaded that peace can be ensured in the overall Mediterranean region as it was during the Yom Kippur war. But to answer the question, if a choice were possible in a war, I would rather start from a disengaged position.

Senator GOLDWATER. What enemy threat weapons concerned you the most and which the least?

Admiral TURNER. [Deleted] long range bombers [deleted] and [deleted] submarines concerned me the most. Surface ships were the least threat.

Senator GOLDWATER. What potential threat tactics concerned you the most? Which the least?

Admiral TURNER. [Deleted] attack from submarines and long range aircraft was the most worrisome threat; the least concern involved conventional ships.

Senator GOLDWATER. What tactics would you have utilized if fighting had started?

Digitized by Google

Admiral TURNER. In response to hostile acts by the Soviets we would have eliminated [deleted] the evident threat in the immediate area. Further action would have been in response to national direction. [Deleted.]

Senator GOLDWATER. What benefits would you get if NATO allies' warships operated with you?

Admiral TURNER. We would get, as we so often have gotten in the past, strength of numbers, the political psychologic impact of apparent unity, diverse platforms, sensors, and weapons—all of which complicate a potential enemy's problems.

Senator GOLDWATER. Did your own destroyers have adequate gun firepower [deleted]?

Admiral TURNER. Yes, our escorts [deleted] would have been capable of this task. Our guns have comparable rates of fire; they are of greater caliber and hits would have had a telling effect. Of course we planned to use the total assets available and capitalize on our airpower. Our attack-fighters from the carrier decks would have played a large role [deleted] as well as any other enemy surface force.

Senator GOLDWATER. How would the *Nimitz* have improved the situation if she had been available at that time, in place of the FDR?

Admiral TURNER. Aside from her relative freedom from the normal logistics train, *Nimitz* would have provided a 50% increase in aircraft over those carried by FDR; her superior speed would have permitted far greater mobility; her much better sea keeping capability (steadier platform) would have enabled continued flight operations whereas bad weather conditions on one or two occasions prevented FDR from operating her aircraft.

Senator GOLDWATER. How has the introduction of the EA–6B helped such a situation?

Admiral TURNER. The EA–6B is one of the most valuable additions to our capabilities in modern electronic warfare. Its [deleted] enables early detection of enemy [deleted] and provides warning of impending or on-going hostile activities. The EA–6B also has the capability to jam or confuse enemy [deleted] thereby greatly reducing the effectiveness of Soviet [deleted] and reducing the probability or extent of [deleted]. Used in an offensive role against the Soviet ships the EA–6B would have been able to blind enemy radars and defensive systems thus adding to the effectiveness of our attack aircraft.

Senator CANNON. How much of the Navy's aircraft procurement amount in fiscal year 1978 is for TACAIR programs, including the Navy and Marine Corps? Also, how much of that is purely Navy carrier related?

Admiral TURNER. The TACAIR programs included in the fiscal year 1978 procurement request are the A–4M, A–6E, EA–6B, A–7E, F–14, F–18, AH–1T and E–2C. These programs total 76 aircraft for $1,563.0 milion. All TACAIR programs with the exclusion of the AH–1T are Navy/Marine Corps carrier related. The Navy/Marine Corps carrier related TACAIR programs total 68 aircraft for $1,531.8 million. The carrier based Anti-Submarine Warfare aircraft are not included in these totals.

Senator CANNON. What is your FYDP yearly totals for fiscal year 1978–82 for Department of Navy TACAIR as projected in the fiscal year 1978 five years defense plan, and how man new planes will be bought each year?

Admiral TURNER. The A–4M, A–6E, EA–6B, A–7E, F–14, F–18, AH–1T and E–2C aircraft procurement reflected in the FYDP plan is as follows:

	Aircraft quantity	Procurement cost (millions)
Year:		
1978	76	$1,563.0
1979	96	2,324.1
1980	114	2,571.0
1981	120	2,302.7
1982	126	1,828.5

Senator CANNON. Are there any problems in achieving the current FYDP program in the out years?

Admiral TURNER. There are problems, certainly; however, these problems will be worked out in the normal planning and programming cycle that is currently in progress. The single overriding problem is that of affordability. We cannot do all that we would like to do.

Digitized by Google

Senator CANNON. Admiral Turner, your charts show that the Navy has reduced from a 26 carrier force in 1962 to 13 today, so you have been cut in half in number of platforms. On the other hand most of those 26 carriers in 1962 were the old Essex and Hancock class ships of about 38,000 tons. Therefore they were considerably smaller, and albeit less capable on an individual basis, there were many more of them to spread around the world's oceans.

Today's carrier debate seems to center on this overall question of the effect of numbers versus individual capability. For the record would you provide figures on the total tonnage of the carriers, the number of men that were required to man that 26 carrier force, what the annual operating cost was, and what the total air wing capability was as compared to today's 13 carrier force of much larger carriers. I know that some of this data will have to be estimated, particularly since those ships were not equipped to operate today's larger jet airplanes, but you could provide parametric-based comparisons.

Admiral TURNER. The following is a tabulation of the information requested. The operating cost and personnel figures (1962) were extrapolated from manning and costing data available for CVA's and CVS' in 1972 and then applied to the 10 CVS' and 16 CVA's that were in the inventory in 1962.

	Fiscal year—	
	1962	1977
Carrier force levels	10 CVS/15 CVA/1 CVAN [1]	11 CV's/2 CVN's.[1]
Total personnel (air wing and ship)	93,000	67,000.
Total tonnage (full load displacement)	1,362,000 tons	1,014,000 tons.
Annual operating cost (air wing and ship)	$2,779,641,000 [2]	$1,612,800,000.[2]

[1] Until recently aircraft carriers have been designated CVA or CVS with an "N" added for nuclear propulsion. The "A" identified an attack carrier and the "S" an antisubmarine warfare (ASW) carrier. The designation of CV's and CVN's today describes the multimission capability of modern aircraft carriers.

[2] Annual operating cost includes O. & M.N. and MPN funds and are in fiscal year 1978 dollars for comparison.

In gross numbers there were approximately 40 percent more aircraft embarked (1,600 versus 1,150)in aircraft carriers in 1962 than in 1977. The overwhelming increase in the individual capability of our modern aircraft could possibly indicate that tactical sea based air is more capable today, even with reduced numbers, than in 1962. However, this increase in capability is relative and must be weighed against an equivalent increase in the enemy's capability. A major factor to be considered in this analysis, as you have stated, is the loss in flexibility with the reduction in numbers of carriers.

Senator CANNON. Could the Franklin D. Roosevelt, *Coral Sea*, and *Midway* be SLEP'ed and their lifetimes extended further in order to keep a larger number of carriers in operation? Is that a practical possibility?

Admiral TURNER. A program to extend the service lives of the USS *Midway* (CV–41), the USS *Roosevelt* (CV–42) and USS *Coral Sea* (CV–43) is not practical from a cost or an operational analysis. To support aircraft of the mid-1980's, the ships would require extensive restructuring. Even if this effort and the extensive overhaul of the old machinery were cost effective, the installation of the electronic equipment required to support these aircraft would occupy excessive space on a ship of this size and severely limit the aircraft loading.

Senator CANNON. How does the current concept of the CVV compare to the FDR or *Midway* Class carrier and also the *Nimitz* Class in terms of tonnage, number of catapults and arresting gear, and air wing complement? Also would you provide a table for the record with those specific comparisons?

Admiral TURNER. The following provides a comparison of the CVV to the *Midway* and *Nimitz* Class carriers:

	CVV [1]	Midway class	Nimitz class
Displacement (standard)	50,000 tons	53,000	81,600.
Catapults	2 C–13 mod 1	2C–13 mod 0	4 C–13 mod 1.
Arresting gear	3 plus Barricade	3 plus Barricade	4 plus Barricade.
Air wing	50 to 55	79 to 80	90 to 95.

[1] The CVV is still in the conceptual design phase and the data provided is the best estimate at this time. This ship will be capable of operating all the carrier aircraft presently in the Navy's inventory.

88-379 O - 77 - 37

Digitized by Google

Senator GOLDWATER. Admiral Turner, this Subcommittee has viewed the TACAIR airplanes as falling into various mission areas, that is, air-to-air fighters, light attack and all-weather attack as the combat airplanes, and radar warning, electronic jamming, reconnaissance, tankers, and airlift as the combat support missions. The Navy now has airplanes in production for all of these missions and two more replacements under development, the F–18 and AV–8B V/STOL. Since the Navy is hoping to introduce V/STOL airplanes in the late 1980's to mid-1990's time period to replace the current F–14's, A–6's, E–2C's, EA–6B's, etc.; what is your extended planning program for the 1980's? Will you basically be buying attrition replacements for the present inventory through that time period, or are any new conventional airplane programs envisioned as entering development during the 1980's?

Admiral TURNER. Our basic plan is to (a) buy replacement aircraft to assure the maintenance of present force levels, (b) continue the introduction of F–18 and AV–8B, and (c) work toward the long term development of V/STOL.

Senator CANNON. Admiral Turner, it appears that the force level has been reduced in the SH–3 program from 8 to 6 UE, this seems incongruous with the postulated ASW threat.

Admiral TURNER. The reduction of the SH–3H from 8 to 6 per CV is based on a Program Decision Memorandum which was issued by the Office of the Secretary of Defense. The PDM originally directed the removal of all SH–3H helicopters from the CV and the operation of a reduced number of SH–3Hs from the DD–963. We made a reclama to this decision which was only partially successful .The final decision reduced the CV ASW helicopters from 8 to 6 and directed that SH–3H detachments operate from DD–963 combatants when they are in company with the CV. This will in effect reduce the carrier UE to four SH–3H's but still keep the task group UE at six.

Senator CANNON. What ships will be able to operate the Type A, B, and C?

What is the relative efficiency of a conventional aircraft carrier versus a purely V/STOL aircraft carrier? In other words what percent of the deck space and internal volume of a conventional carrier is dedicated to catapults and arresting gear?

Admiral TURNER. The present plan is that all ships ranging in size from the DD–963 class destroyers up through the *Nimitz* class aircraft carriers will be able to operate the type A, B, and C V/STOL aircraft.

3.1 percent of the internal volume of a conventional carrier (4 catapults and 4 arresting gear) is dedicated to catapults and arresting gear and 2.8 percent of the internal deck space. Specific areas on the flight deck must be cleared for launch and recovery of aircraft. However, there is no flight deck space solely dedicated to catapults and arresting gear.

Senator CANNON. What percentage of the cost of a conventional carrier is in the catapults and arresting gear?

Admiral TURNER. The cost for procurement and installation of catapults and arresting gear (4 catapult ship) on a conventional carrier is 4.3 percent of the total cost of the ship.

Senator CANNON. What percent of the volume of a conventional carrier is used for aircraft (including operations, storage, and maintenance), what percent is used for fuel and weapons storage, and what percent goes to crew use, such as living spaces, etc.?

Admiral TURNER. 25.6 perecnt of the volume of a conventional carrier is used for aircraft, 3.0 percent for fuel, 6.6 percent for weapons storage and 21.8 percent for crew use. The remaining 43 percent is devoted to engineering, ship's storage and electronics.

Senator CANNON. What are the mission functions performed by carrier air wing aircraft today, and will these mission functions change in the future or will all be required to be performed by the V/STOL aircraft?

Admiral TURNER. As we look at the future threat, the missions the Navy must perform, the same functions as performed today will be required in naval aircraft in the future. Currently, air wing aircraft include the basic combat and combat support types of tactical aircraft. The combat aircraft include fighters, light attack, and medium attack aircraft. The combat support aircraft include airborne early warning, electronic warfare, reconnaissance, antisubmarine warfare, tankers and carrier onboard delivery. These tasks, such as antisubmarine warfare, or airborne early warning, will not necessarily be performed in the same manner as today, or necessarily by a dedicated aircraft. We are studying all the tasks required of naval aircraft to determine most optimum utilization

Digitized by Google

of our assets. The missions can be mutually supportive. We will design our aircraft to take advantage of this. We continually strive for multi-mission application of aircraft. We have grouped our aircraft into compatible mission requiremens under two generic classes: Type A and B. Type A will include the subsonic, long time on station, large internal volume, tasks such as antisubmarine warfare, airborne early warning. Type B will be a high performance, fighter attack aircraft.

Senator CANNON. How many airplanes perform each mission function in today's conventional airplane air wing?

Admiral TURNER. The National Carrier Air Wing Composition for our modern CVs is 24 fighters, 24 light attack, 12 medium attack, 4 airborne early warning, 4 electronic warfare, 3 reconnaissance, 4 tankers, 10 fixed wing ASW and 6 helicopter ASW aircraft.

Senator CANNON. How many different airplane types are in today's air wing?

Admiral TURNER. Today's air wing utilizes nine different types of aircraft; F–14 or F–4 fighters, A–7 light attack, A–6 medium attack, E–2 early warning, EA–6B electronic warfare, RA–5 or RF–8 reconnaissance, KA–6D tankers, S–3 fixed wing ASW and SH–3 helicopter ASW.

Senator CANNON. How will those numbers change in an all V/STOL air wing?

Admiral TURNER. The Navy is just beginning to investigate V/STOL therefore it is difficult to provide a definitive answer. I do envision that the total numbers of aircraft in an all V/STOL air wing will approximate those of today's CTOL air wing. The significant advance will be achieved in reducing the number of different types of aircraft to only two basic airframes, the type "A" and type "B" V/STOL. The type "A" will be a subsonic aircraft that will be configured with different specific mission weapon system suites to replace our E–2s, S–3s, tankers and helicopters. The type "B" will be a supersonic airframe with different weapon systems to replace our fighters and attack aircraft.

Senator CANNON. What is the combat striking power of today's conventional air wing, both for a *Nimitz* size carrier and for a *Midway* size carrier, and what will be the relative striking power of a V/STOL carrier air wing?

Admiral TURNER. The *Nimitz* air wing has 93 aircraft while the *Midway* air wing has 79 aircraft. The principal differences between these two wings are these: the *Nimitz* air wing includes 10 S–3A and 8 SH–3H anti-submarine warfare aircraft; *Midway* has no fixed-wing S–3 aircraft and only 5 utility helicopters. They each have 24 fighters and 36 attack aircraft for striking power, but *Nimitz* is equipped with the vastly superior F–14. *Midway* uses F–4J fighters and is not capable of handling the F–14.

The first CVV will be capable of handling both V/STOL aircraft and the conventional take-off and landing (CTOL) aircraft that are presently in the inventory. We anticipate that fifty to fifty-five aircraft will be carried by this first CVV. When we studied the relative effectiveness of the CTOL aircraft of the *Nimitz* air wing with a notional air wing of 51 to 52 CTOL aircraft, we concluded [deleted]. In summarizing the relative effectiveness of the two air wings in a projection scenario, our study concluded that [deleted].

With subsequent CVVs employing strictly V/STOL aircraft in the 1990s, we anticipate that their air wings will have a capability equal to that of the notional air wing in the above comparison.

Senator CANNON. How does the combat striking power of a *Nimitz* air wing compare to that of the Soviet V/STOL *Kiev* carrier's air wing?

Admiral TURNER. The *Nimitz* air wing's capability far exceeds that of the Soviet *Kiev* carrier's air wing.

The *Kiev* can carry [deleted] fixed-wing V/STOL aircraft (the Yak–36 Forger), or a maximum of [deleted] KA–25 Hormone helicopters or combinations of the two adjusted for the ship's various missions. The normal complement of the *Kiev* carrier's air wing is estimated to be a mix of [deleted] V/STOL aircraft and [deleted] helicopters.

The Yak–36 Forger's missions include [deleted].

The Hormone ASW helicopter can [deleted].

The integral weapons systems of the *Kiev* include eight surface-to-air missile launchers, four 76 MM guns, eight [deleted] "Gatling" guns and [deleted] ASW rocket launchers.

In contrast, the *Nimitz* air wing includes 93 aircraft: 24 fighters, 36 attack aircraft, 10 fixed wing and 8 helicopter ASW aircraft, four tankers, four electronic warfare aircraft, four early warning aircraft and three reconnaissance

Digitized by Google

aircraft. In every respect—range, endurance, weapons load, maneuverability, missile systems, sensors, crew readiness—the *Nimitz* air wing exceeds the *Kiev* air wing in both numbers and performance.

Senator CANNON. How will the *Kiev's* air wing compare with the United States Navy's V/STOL Carrier Air Wing in combat strike power?

Admiral TURNER. Because the U.S. Navy's V/STOL carrier will be capable of handling over 50 aircraft as opposed to the *Kiev's* normal complement of [deleted] aircraft, our CVV air wing will continue to be superior to the *Kiev's* air wing in every mission. But, if we also include in the equation *Kiev's* integral missiles, guns, depth bombs, [deleted]—we would have to conclude that our only ship more effective in all warfare areas is the large multipurpose carrier with its more capable air wing.

Senator CANNON. Given the capability of medium-performance aircraft, such as the AV-8B, when equipped with "smart" weapons, would not the Navy's net position be better with these aircraft on large numbers of small V/STOL aircraft carriers, than with F-18s on a small number of large carriers?

Admiral TURNER. It is too early to submit a positive statement regarding the dispersal concept versus concentrated mass employment. The Navy is performing several operational analysis studies looking at various aspects of V/STOL. These studies are addressing how we would employ V/STOL, its effectiveness and how V/STOL and conventional forces compare.

Senator CANNON. What is the status of the Thrust Augmented Wing V/STOL Prototype Program?

Admiral TURNER. *Status.*—The original purpose of the XFV-12A (TAW) V/STOL program was to evaluate, with two prototype aircraft, the thrust augmented wing lifting concept. A success oriented contract was established with Rockwell International Columbus Aircraft Division (RI-CAD) which called for incremental funding over a four-year period. By the beginning of 1976, the contractor had not been able to achieve the technical goals originally planned. Part of this inability to achieve desired goals was due to funding perturbations in fiscal year 73/74/75. However, the contractor was provided $17.M in fiscal year 76 funds, $2.4M in fiscal year 7T funds, and $4.9M in fiscal year 77 funds. These funds were not made available to the contractor as originally planned, however. The TAW program has progressed, but has also experienced difficulties during this past year. Fabrication of prototype number two was halted in November 1976 due to insufficient funds.

The first airplane is nearly complete; only the canard, some actuators and other assemblies remain to be fabricated and permanently installed. The program is severely short funded in fiscal year-77, however, and any significant further progress will require additional funds.

Recent progress.—Wing and canard augmenter design completed 3-76 and 9-76. These designs included built-in test flexibility to facilitate the incorporation of improved augmenter arrangements.

Completion of airframe, systems and ducting design 6-76.

Ground effect tests with 0.2 scale model 4-76.

Mechanical check-out and proof load of control system mixer 12-76.

Airworthiness testing of flight control actuators (Wing) 1-77.

Completion and zero leakage pressure testing of left hand wing augmenters 2-77.

0.2 scale wind tunnel testing 7-76 and 10-76.

Completion and 100 percent proof load testing of vertical tails and pod 1-77.

Development of unique V/TOL tether test concept using NASA Langley Impact Dynamic Research Facility. Design completion for winch control, electrical, emergency and structural interface components completed. Concept 7-76, Design 2-77.

Modification and preparation of the Langley tether test facility partially completed. Winch installed atop facility, concrete poured, cables procured, temporary hangar contracted for, 2-77. Scheduled completion is in July 1977.

Mr. CROMWELL. The committee will stand in recess until tomorrow morning, when we will hear the presentation on the Enforcer.

[Whereupon at 1:51 p.m., the subcommittee recessed, to reconvene the following day.]

Digitized by Google

MILITARY PROCUREMENT, FISCAL YEAR 1978

WEDNESDAY, MARCH 16, 1977

U. S. SENATE,
SUBCOMMITTEE ON TACTICAL AIR
OF THE COMMITTEE ON ARMED SERVICES,
Washington, D.C.

ENFORCER AIRCRAFT

The subcommittee met, pursuant to notice, at 9 a.m., in room 224, Russell Senate Office Building, Senator Barry Goldwater presiding.

Present: Senators Goldwater and Thurmond.

Also present: Robert Q. Old, Charles H. Cromwell, and Edward B. Kenney, professional staff members.

Senator GOLDWATER. The meeting will come to order. Unless there is objection, the meeting will be open. Do I hear any objection?

[No response.]

Senator GOLDWATER. The meeting will be open.

I express the regrets of my chairman at not being able to be here, but his mother's health continues bad, and he cannot be with us.

The following opening statement is presented for Senator Cannon, who is unable to attend today's hearing because of an illness in his family.

Today the Tactical Air Subcommittee will hear testimony on the Enforcer aircraft. This hearing has been called at the specific request of Senator Strom Thurmond.

The Enforcer airplane is a World War II, P-51 fighter reengined with a turbo prop. For some time now its advocates have been promoting it as a close air support airplane. Many hearings have been held in the past, particularly by the House Armed Services Committee, and 2 years ago by our own Research and Development Subcommittee.

Our principal witnesses this morning are Gen. Alton Slay, Deputy Chief of Staff, R. & D., who will present the Air Force's position on the Enforcer program. He will be followed by Mr. David Lindsay, developer of the Enforcer aircraft, and Mr. J. Lynn Helms, president, Piper Aircraft Corp.

We will lead off with General Slay's presentation, follow with the remarks of Mr. Lindsay and Mr. Helms, and then open the hearing to questions and answers with all of the witnesses.

Now, General, will you begin your presentation?

Digitized by Google

STATEMENT OF LT. GEN. ALTON D. SLAY, DEPUTY CHIEF OF STAFF, RESEARCH AND DEVELOPMENT, U.S. AIR FORCE

General SLAY. Mr. Chairman, thank you very much. We appreciate the opportunity of being here this morning to present the Air Force views on Enforcer.

As the committee knows, back in 1974 the Chief of Staff of the Air Force directed Lt. Gen. James Stewart, who was at that time Commander of Aeronautical Systems Division, to undertake a complete review of the Enforcer proposal as proposed by its developer. General Stewart was asked to look in detail at all of the technical aspects of the Enforcer aircraft and to ascertain as best he could what interest there was in foreign countries in Enforcer, but more specifically to advise the Chief of Staff on the technical merits of the Enforcer proposal.

As a corollary effort, our studies and analysis group within the headquarters Air Force was asked to run an analysis on the cost effectiveness and tactical benefits of Enforcer were it introduced into the U.S. Air Force stable.

These works were completed and the major conclusions of these efforts were four: First of all, that previous evaluations of the aircraft were accurate, that the appraisals of Enforcer which had been made in the past were accurate; second, that an all A–10 force was most cost effective, and that there is no place for Enforcer in the Air Force inventory, third, that significant foreign military sales potential was not evident; fourth, they concluded that the Air Force should not undertake or support further flight testing of the Enforcer.

In general, the Air Force report agreed with the aerodynamic performance of the Enforcer as claimed by its designer, in other words, speed, range, take-off, landing capability, et cetera; however, their analysis showed that compared to the A–10 the Enforcer was deficient in two very important attributes of a close air support aircraft. That was lethality and survivability, those two attributes.

Mr. Chairman, we believe that based upon what is already known about the prototype aircraft and what can be predicted with confidence, there is no need for a flight test of the system. We believe that if we had a requirement for Enforcer, and if a decision were made to proceed with full scale development of the aircraft, we could do it without preliminary flight tests of the prototype aircraft.

In any event, we would feel, that prior to a decision to go into development of such a system, it would be necessary as well as beneficial to the Government and to the taxpayer to conduct an industrywide competition. It might be of interest to the committee to know that the Air Force has received several unsolicited proposals for similar systems which would be in competition with Enforcer.

Mr. Chairman, the Air Force position is that our earlier statements of need concerning Enforcer are still valid, that there is no place in the Air Force inventory for an aircraft such as Enforcer, particularly since we are constrained in personnel strength figures. Our limit for expansion of our force is very small.

Therefore, we would like to restate and reiterate our earlier commentary on the Enforcer, that this is not the aircraft that we would like to see entered into our active tactical inventory. Thank you.

Digitized by Google

Senator GOLDWATER. I have just one question that Senator Cannon would have asked of General Slay at this time.

General, is it the Air Force's opinion that building prototypes of the Enforcer would be a waste of the taxpayers' money?

General SLAY. In my opinion, and I think it is shared by the senior management within the Air Force, it would be, sir.

Senator GOLDWATER. Any other comments by members of the Air Force? [No response.]

All right. Mr. Lindsay, you can proceed any way that you care to. I have known Mr. Lindsay for a good many years. I have seen the aircraft that he has built under the name of Cavalier, and I have also seen the prototype some years ago of the Enforcer. So, Mr. Lindsay, you can proceed in any way that you want, and Mr. Helms, I guess the two of you are going to handle this, so it is all yours.

STATEMENT OF DAVID LINDSAY, DEVELOPER OF THE ENFORCER AIRCRAFT, AND J. LYNN HELMS, PRESIDENT, PIPER AIRCRAFT; ACCOMPANIED BY PAUL LOVINGTON, LYCOMING DIVISION OF AVCO, AND W. A. BAKER, CHIEF ENGINEER, BRISTOL COMPOSITE MATERIALS, LTD.

Mr. LINDSAY. Thank you, Senator, I think the first thing I should do is express our appreciation for being here, but at the same time to say that in appearing before the Research and Development Committees of the two Houses, we thought since we were essentially asking for tests, and that this had been privately funded R. & D., we were in the right channels, and we apologize for any offense to the protocol of the Senate such as was discussed on the floor.

We feel very strongly, more so than ever before, that the effects of the inflation and the increasing sophistication of aircraft systems have made the price of most of the weapons now designed for close support cost so many millions of dollars each that it may be impossible to acquire a sufficient number of them to provide the credibility both to our allies and to our enemies that only large numbers can assure.

When I say the credibility to our enemies, I mean I feel the people who are over there on the North German Plains need to see aircraft in being that can be moved around constantly, but they have to know that there is some hope in their fighting.

You are all aware, as I am, of the tremendous threat faced there, and that has been highlighted recently by the analysis, "NATO and The New Soviet Threat," prepared by Senator Nunn of this subcommittee and Senator Bartlett of the Armed Services Committee. I think the whole tactical situation has increasingly grown worse, with the possibility now for the Soviets to move from a standing start, without the warnings that might have occurred with the callup of Warsaw Pact troops before.

This is why we are still continuing our effort to provide something that we feel the Nation desperately needs.

Two quotations from the Senators' analysis drive home the point that heavily armored, heavily armed, and forward-baseable close-support aircraft are urgently needed to supplement other air and ground resources to counter the tremendous preponderance of Soviet armor.

Digitized by Google

The first of these comments is that of a knowledgable German strategist quoted in the analysis:

During the past 18 months NATO has played five war games, and my country has been "defended" five times and "destroyed" five times.

That the Pentagon planners have been placing too much reliance on tactical nuclear weapons has become painfully obvious.

The other quotation points up the essentiality of having deployed for immediate close-air-support response aircraft whose first and unchanging mission is to aid the ground forces in breaking an onslaught of tanks and armored divisions. A ranking NATO officer was quoted in the analysis on this point:

The air war in the central region has shifted westward, and although the other mission of NATO's air force remains providing the Army firepower, we must now save ourselves before we can save the Army.

We believe that the Enforcer, because if is designed for inexpensive mass production, may offer the best chance to provide the numbers of aircraft that are called on to cope with 16,000 main battle tanks.

As you all know, the rate of American tank production is far below that desired, funding aside.

Senator GOLDWATER. Mr. Lindsay, I might say, it is 41,000 tanks.

Mr. LINDSAY. Yes, sir, your figure is absolutely correct. I was referring to those presently deployed on the line.

Senator GOLDWATER. They have 41,000 tanks and we have 9,000, and they do not have them all over there, either.

Mr. LINDSAY. Yes, sir. That is very true.

Another point on which I believe we can achieve agreement is that the Soviet weaponry which was first revealed in the October 1973 war in the Middle East has caused a drastic revaluation of the close air support as regards survivability.

The Soviet heat-seeking missiles and tank-supported Quad ZSU-23 automatic 23 mm. cannon have made the close-air-support arena so lethal that many analysis feel that the days of driving to attack with weapons such as iron bombs may necessarily be a thing of the past.

Today, there is general agreement that pinpoint close-air-support will have to be performed with standoff weaponry of the fire-and-forget variety, such as missiles or long-range guns, or with extremely low-level delivery of cluster-bomb weapons. Even then, I think the most optimistic of us in aviation feel that high losses must be expected.

The Enforcer is more heavily armored against enemy fire than any aircraft in the world. This is one of the misunderstandings that we wanted to come here to correct. Twenty percent of its weight is devoted to armor. That is, its empty weight, of course. It is particularly well adapted to utilization in the high lethality environment of central Europe. It is the most survivable close-air-support available.

The Enforcer's extremely low infrared signature achieved by unique ram-air cool exhaust over the left wing, produces a minimum signature from the quartering left rear, the only direction from which it might be acquired, and it is completely masked from other directions, including downward, the source of most handheld missiles.

Since it is generally accepted that all prepared airfields in the central European battle area are pretargeted, and will be almost immediately destroyed in the event of attack, the Enforcer is probably the

Digitized by Google

only close-air-support aircraft which would be effectively operational after the onset of either a nonnuclear or nuclear attack, because it can take off and land in short distances, on muddy, unpaved, or rough fields—the only fields then likely to be available to NATO forces.

A large number of inexpensive Enforcers could be dispersed at frequently reassigned strips or unpaved areas from which they could respond quickly to calls for assistance.

When I was recently at Tactical Air Headquarters, a friend of mine, who is a very good fighter pilot, suggested that they possibly should be based along the autobanns, although he pointed out that, in an emergency, the autobanns, would be clogged, but he said, have them there for visibility but have them there precoded and assigned to pastures and fields, where they would be rotated constantly, but always have some in sights for the Germans to see, to encourage them to make the fight against that mass of tanks we are talking about.

Pilots could be Air Force, Army, Navy, Marine. I say that because I have great affection for the Air Force, my father having served in it in two wars and much of the information I have obtained on fighter aircraft having come from the Air Force, but I do recognize that their budget is now being pushed up into the stratosphere and beyond. In the broad military viewpoint, they must combat laser weapons and other very advanced devices being developed by the Soviets. Just how far the Air Force budget can extend, I do not know. So perhaps Army and others might have to be called in.

I do feel, though, that regardless of service, pilot observers should be trained with ground combat troops to provide the closest possible liaison and maximum personal knowledge of their assigned areas of operation.

I have been very impressed with the Army's program of sending out its helicopter pilots in north Germany in all weather and all sorts of conditions so that they can identify practically every little outbuilding around the area, every creek and roadbed, and in the event that there is jamming of the gigahertz and the megahertz frequencies and all the rest of the hertz, they will be able to operate by looking at where the noise, the sound, and the thunder of the attack are coming from, and maintain operations on an emergency basis until things can be stabilized.

The Enforcer, as is the existing prototype, would be equipped with radios capable of communicating with the full spectrum of ground and air combat frequencies. If centralized control proves feasible, this capability would allow the Enforcer to operate in that mode. However, if central control should break down, communications with ground units could be maintained directly.

Even though the Enforcer is less vulnerable than other proposed close-air-support weapons, in today's high lethality, high materiel-usage environment, it is still necessary to minimize exposure by utilizing low-altitude, on-the-deck attacks and withdrawals, popping up only long enough to fire standoff weaponry such as Maverick missiles, 30-mm automatic cannon, and so forth.

Now, Senator Cannon made a statement, which is fully understandable, in that many people confuse the operation which I had for many years at Cavalier with the P–51 Mustang, but actually the Enforcer is not a P–51. I cannot stress that enough, gentlemen. Because of the

Digitized by Google

stringencies of private financing, it did use a number of P–51 parts. A–1 parts, many other aircraft parts. It used ejection-extraction seats from other aircraft. It uses the Marconi-Elliott heads-up display from the very latest of the A–4 series.

It uses a unique armament system which the P–51 never had. But I would like to submit to you that when you design an airplane and it is one man high and one man wide and you make it as small as possible to carry the necessary armor and ordnance, and put a propeller up front, it is likely to look like a P–51 or an ME–109 or a Sea Fury or many other aircraft. I think that is one thing that I would like to lay to rest, if possible.

We did use P–51 components for an inexpensive prototype, but the design—and this has been verified by the Air Force, Fred Rall and his fine staff of engineers, and by the Navy in their design analysis—is actually, in effect, a new aircraft, and they have so stated in public sessions of the R. & D. committee.

Senator GOLDWATER. That is one point I was going to raise. I am glad you brought it up, because I had written down a question: Would you depend on World War II P–51's? I ask it because I do not think there are many of them around.

Mr. LINDSAY. Senator, we do not propose in the program which we are asking for today—which, I would like to stress, is only a test program—we propose to use only limited amounts of any P–51 aircraft parts, all of which are in our warehouse stocks.

Senator GOLDWATER. Now, is Piper proposing to build the new airframe?

Mr. LINDSAY. Piper, at this time, is proposing an entirely new airframe to different stresses, to different wing interior designs, to different fusilage designs, utilizing the latest in airconditioning equipment from Hamilton-Standard, and Mr. Helms can be more explicit as to that point, but the prototype which I built used only private funds (mine, Piper's, Lycoming's, Bendix's, Bristol's, and others), and obviously we had to conserve, and it is therefore a composite prototype.

Senator GOLDWATER. Mr. Helms, are you going to into this? I had heard that Piper was interested. Are you going to describe the new airframe?

Mr. HELMS. Senator, we are not at this time proposing a production program of any kind, in an effort to hold the cost down and validate the operational effectiveness. That is the key word, operational effectiveness, as opposed to an aerodynamic prototype. We believe that this should be done in the fastest and cheapest way possible.

Therefore, we would utilize hulks of four aircraft which are partial P–51's, but they are partial other aircraft, other engines, other propellers, other things, and that allows us to use soft tooling rather than hard tooling, thereby substantiating our low cost estimate.

So, for the four aircraft, we would assemble them from parts, using some soft tooling.

Mr. LINDSAY. I just have four little slides to break up my conservation. I wonder if you would mind showing the one on the end? Some people even had the thought that the Enforcer is a piston aircraft from World War II.

That slide is the engine, which is built by Avco-Lycoming. As you can see, it is definitely "state of the art." The core engine is on the

Digitized by Google

Chinook helicopter. There are millions of flight hours on it, and that is the engine we are using. It is a very efficient, very fuel-efficient and very rugged jet turbine engine turning a propeller.

Senator GOLDWATER. What is your shaft horsepower on that?

Mr. LINDSAY. The one which we have is one which we leased from the Air Force, via administration by the Navy. It is 2,450-shaft horsepower. It went through a wreck when it was in the custody of North American, and Lycoming rebuilt it at their own expense. But the production version, which is in production now for Iran for the 214 helicopter, is 2,950-shaft horsepower, and that is what we are proposing.

We have done some weapons testing. We had cooperation that was available because people wanted to try out various things, and they said, why not try it out on that airplane? If I look like I am standing in front of those rockets, I can assure you that is an optical illusion. I am off to the side.

This is the aircraft as it was configured for the Pave Coin operation, which came up rather unexpectedly. It is carrying finned napalm, and 16 each 2-million-candlepower flares, and rocket tubes, and 2,000 rounds of internal 50-caliber ammunition. You will notice that on the left side, above the wing, is the engine exhaust outlet, which is designed so that the more torque you get from the propeller, the more compensation for it you get from the angled thrust. So we can go on up, theoretically, to the limits of the T-55 engine, which actually is 3,900 horsepower. But we frankly do not need that much, Senator, and so we will use the cheaper version in the 2,950 range.

I show that only to emphasize the simplicity of this airplane. Separation of finned napalm of that category—roughly referred to as 1,000-pound—I think it was more like 920—is one of the most difficult stores to create the separation.

This separated with no effort whatever, simply by releasing the bomb rack shackles. You will notice very little, if any, discernible deflection of any of the control surfaces. That is the only purpose in showing this slide.

We have done a limited amount of flight testing to confirm the feasibility and simplicity of this airplane, and the design concept—thank you for the slides. The design concept is really to try for what might be called an elegant solution that obviates complicated solutions to a problem. We try not to have the problem exist.

That is why the air intake is in the front. It is an annular ring around the propeller, and it would be very hard for foreign object damage to get into it, and when we fire any kind of rocket, any kind of gun, we do not get any of the gun gas problems that the A-10 has, as you gentlemen all know.

Senator GOLDWATER. As we go along, what is the wet weight of the aircraft without weapons?

Mr. LINDSAY. The aircraft has an empty weight—do you mean with the pilot and full fuel?

Senator GOLDWATER. Yes.

Mr. LINDSAY. Approximately 12,400 pounds operating weight, with the armor and internal guns with full ammunition. The armor is inte-

Digitized by Google

gral, by the way. This is not armor which we tack on and carry around as a load. The armor, as you will see, is structural armor, which we think is one of the unique features. When we put armor on, that is the engine cowling, so we are getting double duty out of it rather than just carrying it around as a load which reduces our ordnance capability.

The Enforcer can carry and dispense any munitions in the nonnuclear inventory up through the 1,000-pound per unit category. You, Senator, having flown P–51's, know they have a couple of bomb [weapons] racks. Please let me emphasize my point that I totally redesigned the interior of the wings, and it has 10 weapons racks, 2 of which can carry 1,000 pounds, 4 of which can carry 870 pounds, and 2 of which carry 350 pounds.

Not only that, Senator, they have done so, so we are not talking about a dream.

If conditions should permit the use of conventional bombs, it can attack at low- or high-dive angles, just as it can use the antitank Rockeye and other area-dispersal weapons in on-the-deck, overflight delivery.

Now, the Enforcer has been commented on as not being able to defend itself from other aircraft in some of the Air Force presentations. I would suggest to you that it is unequaled because of the 360-degree visibility from the cockpit. As you know and other P–51 pilots such as General Slay know, you can turn around and look straight back in the airplane. It is 360 degrees all around.

In the case of the A–10, you are looking into some huge engines, you are looking into other cockpit apparatus which give almost no visibility to the rear, you are blind down into the rear, and I think a 6 o'clock low approach would be almost certain of success against the A–10.

Senator GOLDWATER. Let me ask you, as long as we are talking about weapons, and pardon my interrupting, can you carry the 20-millimeter Gatling gun?

Mr. LINDSAY. Yes, we can.

Senator GOLDWATER. That would be pod suspended?

Mr. LINDSAY. We have two options on that, sir. We worked with General Electric, and we can offer the aircraft with two three-barrel G.E. Gatling guns mounted in lieu of the six 50-calibers, and this has been debated back and forth and back and forth.

Senator GOLDWATER. In the wing?

Mr. LINDSAY. In the wing. It is a beautiful installation, and the drawings were made for that as part of our design.

Senator GOLDWATER. Is it 20-millimeter?

Mr. LINDSAY. Twenty-millimeter, yes, and alternatively we can carry multiple 20-millimeter pods. We have elected so far to recommend staying with the 50 caliber, because contrary to statements that were made, it is not an obsolete weapon. It is the most reliable weapon. It always functions. There are six of them. It is great for holding down the heads of the troops at the flack sites while you are coming into something heavy, and it has the great advantage of commonality with NATO and the Army. It is the most widely used weapon in the world: $18 million in this year's budget for 50-caliber weapons.

Digitized by Google

So, we offer an option, but we recommend the 50-caliber because we can carry the 20-millimeter in pods, and we can also carry two of the NATO-standard Aden-Defa 30-millimeter pods with 150 rounds each. We think this is a pretty goodly number of rounds, in view of the fact that in the maximum sortie response effort just put on by the A–10's, they had two aircraft operating for some 11 hours, and they fired 100 rounds per sortie.

Incidentally, I am not here to attack the A–10.

Senator GOLDWATER. I understand that.

Mr. LINDSAY. We hope it goes well. We know the Air Force will find uses for it, but all the Air Force comparisons have been against that, and therefore we have to use the common denominator of the comparison.

Senator GOLDWATER. You are talking, then, about a lighter ground attack aircraft than the A–10. Of course, the A–10 has the AU–8 gun in it, which I do not believe your aircraft could carry.

Mr. LINDSAY. No, we cannot carry that, but we feel that the Defa gun which has been built in 10,000 units, it is built on the Mauser or revolver principle, with one very strong steel barrel, is a viable alternative. And we feel that there are advantages to having two guns, in case you have a jam. It also has air recocking features, and we think it is an excellent weapon with Sabot armor-piercing rounds.

Mr. HELMS. Senator, I will address that later in some actual comparisons.

Mr. LINDSAY. Now, in talking to people in Europe, particularly in Germany, they know that the Russians are hanging a certain amount of ordnance on their helicopters as they are using them for troop carrying, and they suggest that the Enforcer would be ideal either as a helicopter escort or helicopter gun-ship backup, or a helicopter killer.

Helicopters really cannot withstand 50-caliber attack, and we have the ability to carry 50-caliber or the 20-millimeter or the Aden-Defa 30-millimeter. The commonality of all this ammunition, including the 30-millimeter, with ground troops, would permit us to land on really minimal type of strips and pick up fuel and ammunition and local observers, because we have a two-seat version available.

I might point out that the specs under which the Army bought this T–55 engine require it to operate either on ordinary jet fuel or diesel or truck fuel in emergency conditions. That is part of the Government requirement.

I will skip over the part about visiting Europe, because I mentioned that before. But I really have not found anyone, as I talked to my friends in the Luftwaffe and the Swedish Air Force and other places—as General Slay knows, when you get with a group of test pilots, they talk pretty frankly about their weaponry—and I have not found anybody yet who does not think it is a pretty good concept.

Senator GOLDWATER. Do not hesitate at any time to skip parts of your prepared testimony. It will all be put in the record.

Mr. LINDSAY. Fine, sir. I will take the privilege of skipping around.

Senator THURMOND. Mr. Chairman, I would also like to suggest to him not to hesitate to take time to present it if you feel it is helpful to your side.

Mr. LINDSAY. Thank you, Senator. I will try to strike a balance there.

Digitized by Google

I think it is important to point out that since we are talking of an inexpensive airplane, the fact that we have designed and have almost completed a dual control trainer version of the aircraft adds considerable interest. As a pilot myself, I am terribly conscious of how few hours my pilot friends on active duty are getting, and I think the trainer aircraft of this kind would be really wonderful for economical proficiency.

Secondly, the rear seat could equally well be used for an observer or weapons officer, and the rear flight instrument panel now installed could be replaced with radar and other specialized optical vision display. In fact, the Enforcer's leathality can be tailored to range from trainer to heavy attack main-battle, in close-support.

I might interrupt just to say that General Stewart, whom we all know, in the hearing of July, 1975, postulated in comparing the Enforcer, "a massive tank assault in the severe Central European and defense environment," and I might just mention at this point some of the things that the Air Force did credit us with. I believe Mr. Rall and General Slay have copies of this R. & D. testimony which went on for two days.

They did say some nice things about us, and I want to give them credit for it, because frankly they were very helpful, very gentlemanly, and even worked out two different schemes for me for equipping the aircraft for the Maverick missile.

We were credited on page 94 with less vulnerability to heat-seeking missiles; on page 88, capability for Maverick missiles and ECM pods and heads-up display; on page 103, the Enforcer armor capable of defeating the Soviet 23 mm. and probably less expensive than titanium. It is less expensive; it is lighter.

They have credited us on page 104 with being smaller in size and less likely to be hit than the A–10. The Enforcer, General Stewart said, and I quote directly, "could operate from softer surfaces, and in operating in unprepared areas, there are some advantages for airplanes with a two-wheel landing gear and a tail wheel as opposed to a nose gear."

In fact, the information furnished me by the professional staff indicates that the forward air definition of the Enforcer now requires a—excuse me, not the Enforcer, the A–10, now requires a hard surface runway.

They also point out on page 104 that the A–10 and Enforcer operate in generally the same speed range, although I am informed in recently published items in Aviation Week and Aerospace Daily that the speed of the A–10 has not met specifications. I believe it is something like 42 knots less than was anticipated, and that it does suffer from a lack of excess thrust, and it has a drag problem which was written up recently. Well, Mr. Helms can go into that.

Now, I would like to stress another thing. This aircraft is unique in that it was developed without any Government fund, and the Enforcer represents, as far as I know, the first time in the history of the DOD that an attack aircraft weapons system was designed, built, and tested without any government funding whatever.

The Enforcer is a one-man-high, one-man-wide, single turbine, conventional gear, low wing aircraft made entirely of standard aircraft

Digitized by Google

aluminum and the world's most effective armor. It has been designed for either two internal GE 20-mm. three-barrel Gatling guns or six internal 50's.

It is essentially an agile but stable platform to deliver ordnance. Its unrefueled range or loiter is greater than any aircraft in its category, and in the Senate R. & D. Subcommittee hearing it was agreed that we could deploy worldwide without air-to-air refueling. We do not have an air-to-air refueling capability, and I would strongly recommend against it, because I do not want to see anything on the design that is not mission-essential.

Its speed range is 80 to 400 knots, which places it in the speed range selected as optimum by the Air Force for its A–10, but a range which the A–10 has failed to meet.

Now, you may ask, and probably have already wondered to yourself, why an artillery officer of World War II, a newspaper publisher for a quarter of a century, is here discussing a close-support aircraft weapons system.

To explain as briefly as possible, I have been a pilot since 1941, when I started flying while in the Army Reserves, and have flown fighter aircraft as a test pilot since 1957.

The real reason I am here today is that in the late 1960's Deputy Secretary of Defense David Packard, in a widely applauded move, challenged private companies to initiate prototype efforts at their own expense and offer them to the military services, which, he said, would welcome them and test them if they appeared promising.

Now, gentlemen, I believe the things that you have seen and heard indicate that we are promising, and I think we have earned the test.

The challenge intrigued me, and my background in Army ordnance research, fighter flying, and contract work for the U.S. Air Force in building light strike aircraft for military assistance made the close-air-support design field the most logical. I already held a number of aircraft and armament patents which seemed to offer unique promise.

One of those of which I am particularly proud is a basic patent on all ordnance control for a fighter aircraft in the peripheral view of the pilot. In other words, from the time the pilot takes off, he does not have to look down the cockpit at a myriad of panels to set and adjust. They are all right along in his peripheral view. I submit to you that when you are down where we expect to be, in and out of the trees and the church steeples and the balloons, that is a very important factor.

Why a turboprop, it has been asked. Mr. Helms will go into that more than I, so I will pass over it quickly, and simply say that turboprops are simply much more efficient for low-level operations, and low level is where we expect to live in that airplane, if we can live in that environment.

In speaking of close-support, I think we have to avoid another confusion, and that is, we are not talking about interdiction, deep strike, or long-range bombing. I am speaking of air-support as defined by the Joint Chiefs as follows: "Air attacks against hostile targets which are in close proximity to friendly forces." This is a whole different ballgame from anything else, and requires more care and really more losses.

Digitized by Google

I built my first prototype around the Rolls-Royce Dart commercial turboprop engine, and though we were able to prove the soundness of the concept, the engine was too large and too lightly stressed for combat. Several pilots and I did, however, manage to fly this aircraft nearly 100 hours, including demonstration flights to Langley Field and Andrews Air Force Base, nonstop from Sarasota, and we conducted machine gun, rocket, and gun pod firing from an Army range in north Florida.

Now, I will have to admit to you, Senator, just as your and my good friend, Bob Hoover, said, it was a bit "squirrelly." The engine was too big, too long. The CG was not right, and although none of us really had any trouble with it, and felt great confidence in it because of the turbine engine compared to the piston, it was on the "squirrelly" side.

I can assure you that the aircraft today is not "squirrelly", because we designed it around an entirely different engine. I have already dismissed the way we had a new design but a composite prototype, which was primarily dictated by a shortage of funds. Future production of the aircraft would, of course, be completely new manufacture.

In 1971, I sold the Enforcer project to Piper Aircraft Corp.

THE PAVE COIN DIVERSION

This PAVE COIN misunderstanding has harmed us a great deal. While still in the process of moving to Piper, we received an unexpected request from the Air Force to participate in a completely unfunded project open to the aircraft industry, called PAVE COIN. The purpose was to select a close-support aircraft for the Vietnamization program, headed by Maj. Gen. Lesley Bray, and to replace the highly regarded Douglas A-1 Skyraider, for which we all have a lot of respect, and which Senator Cannon on the floor mentioned as being a fine aircraft.

It was, but I might point out it is about twice as big as the Enforcer. Its wheels for rotation are the same size. It had a piston engine. It did not carry anything approaching the Enforcer's armor. It really had only token armor. But it was a fine plane, and I will not in any way denigrate it. We were trying to bring on a state of the art replacement for it.

Now, the reliance on the stated intent of the Air Force to select and procure aircraft in at least the minimum quantity set forth in the request for proposal, we at Piper immediately accelerated to a 7-day overtime schedule. We got engineers in from various other major companies, and Piper spent over $1 million in preparing a proposal and specifications and drawings which are now in storage in enormous crates and scaled up detailing developments. We nevertheless were able to fly the composite prototype configured to PAVE COIN, at Piper's expense, to Eglin Air Force Base. But the rules of the game were to be that we would be analyzed against our proposal, not the hardware we happened to be able to show up with on very short notice, which was in the range of 60 days.

In August, 1971, the Enforcer was flown to Eglin. For all the time it was in Air Force custody, it performed all flight and weapons evaluations by day, and at night under its own flares, with outstand-

Digitized by Google

ing operational results and a remarkable record of zero maintenance during the evaluation period.

Now, mention was made by General Slay of competition. We think we have been competing for a long time, and we think we have won that competition hands down. As no other competing aircraft actually flew the full mission program successfully, we fully expected an order for the minimum requested quote of 400 aircraft, but no selection or purchase of anyone's attack aircraft ever resulted from this operation.

The companies participating lost their investments and had to write them off. Piper returned to further development of the heavy attack Enforcer.

We remainded convinced of the critical need for a specialized close-support, forward deployable aircraft. We continued to improve the Enforcer's performance, weapons capability, armor and survivability, to cope with the increasing lethality of the close-air-support environment.

While one prototype Enforcer remained hangared at Piper's Vero Beach, Fla., facility—where it was taken out and run up weekly, without any maintenance at all, started on its own internal battery. We have continued to seek to obtain operational flight tests.

I might mention in passing I think it is rather remarkable that any airplane can be stored in the range of 4 to 5 years, have no maintenance, and never even have to have an outside-power-assisted start. It was started on its own internal nickel-cadmium battery. I do not know of any other plane that could do that.

Despite the great interest and assistance of a number of Members of Congress in both the Senate and the House, the efforts so far have been unsuccessful. Then-Deputy Secretary Clements did direct an engineering analysis of the Enforcer by the Marine Corps, the Naval Air Systems Command, and the Joint Technical Coordinating Group for Air Survivability. These paper studies, in which we cooperated at considerable expense, consumed nearly a year, and they validated all our claims for the aircraft capability and performance.

So far, however, the Pentagon leadership has not seen fit to go forward with the requested flight tests which are essential to establish many operational and other characteristics which are not susceptible to resolution by computer study.

I believe you once made a rather famous comment, Senator, that: "You have to have a man in the cockpit and his hands on the controls to really determine what an airplane will do."

As you probably know, the U.S. Air Force has been dedicated to pure jet aircraft only, for reasons which many people consider defy logical explanation, and I can include in that group of people who question it many of my pilot friends in the lower grades who are still active in flying.

There is no question that for flying high and fast, the pure jet or the fan jet is the way to go, but for low level operations, the prop-jet offers advantages in acceleration, fuel economy, lessened vulnerability to the serious problems of bird strike damage to engines—which are particularly a problem in Europe—and the ability to operate from short fields.

33-375 O - 77 - 38

Digitized by Google

The Air Force did not accept the Department of Defense-Navy study, and initiated one of its own, utilizing its top engineering personnel at Wright-Patterson Air Force Base, under the overall direction of the Aeronautical Systems Division Commander, Lt. Gen. James Stewart, and the U.S. Air Force Chief Engineer, Mr. Fred Rall, who is sitting behind me on the right here today.

So far as performance and capability of the aircraft, the aircraft study was fair and thorough, and also confirmed our claims. It went on to analyze the Enforcer in the main battle arena against the European tank breakthrough situation in comparison with its own A–10. The Enforcer was clearly shown to be an effective aircraft in this scenario, and it was affirmed that it could operate from unprepared fields.

However, on the production costs which the Air Force attributed to the Enforcer, compared to other aircraft, we of the Enforcer team disagree completely with the Air Force. Piper's well documented production costs are attached as an addendum to this presentation, and are well under $1 million in buys of 400 to 700.

Now, I might point out that Piper builds an enormous number of aircraft. They live in the real world, and the way they built up their figures, Mr. Helms will explain, but it was from actual quotations. We went out for bids to subcontractors. It was not just guesswork.

Despite the high rating given the Enforcer, by the Air Force's own computers, the Pentagon leadership has still not called for operational flight testing. Further, the Air Force and Army continue to abide by an outmoded and totally artificial separation of roles, mutually agreed to many years ago, which provided that the Army not utilize armed fixed-wing aircraft, even though they might be propeller-driven aircraft which the Air Force declines to use.

In effect, this arbitrary agreement, if maintained by the services, puts the Enforcer into a state of limbo, which can only be ended by the Congress or the administration, and that accounts, again, for why we are here.

Our position is very simple. We feel that operational flight tests have clearly been shown as warranted, necessary, and very much in the public interest. They can and should be carried out with the utmost dispatch. I would like to stress that we are only asking for a test program. There is time enough after the tests have finally proven exactly what the Enforcer can do to worry about how the services might best deploy this weapons system.

Even if viewed only as a standby option, should present hopes and performance estimates in the close-air-support weapons field prove overly optimistic, the Enforcer offers prudent and economical insurance to the Nation.

We are now at the point where the Pentagon has been forced to admit that the Enforcer will do all we have claimed and at very low acquisition costs. The bar now to operational flight tests is a remarkable conclusion—that because there is no sponsoring service, there is no requirement for the aircraft. We are thus back to square 1.

There was no official requirement when our efforts began, but a very obvious national need. That need becomes clearer daily as studies indicate the necessity of supplementing sophisticated, overrated, and

Digitized by Google

overexpensive systems. The Armed Services Committee report by Senators Nunn and Bartlett has brought to widespread attention a real and present danger that brings added urgency to getting on with the Enforcer test program.

Some people ask why testing of the Enforcer has been so long a subject of hearings before various committees of the Congress. I feel that the principal problem has been misinterpretation of various written and verbal reports.

Some analyses and conclusions which were provided to congressional committees, gentlemen, were grossly distorted. I make that statement reluctantly, but I have to to be truthful, and some comments on lack of armor and survivability given by the Air Force to members of this committee last year were at direct variance to published Department of Defense studies, unfortunately misleading some Senators.

I sincerely hope that we can now devote our energies to the vital question of what are the best close-support options for our country's security, based on the facts as they exist today.

Now, the other members of our team who have essential information to give you are Mr. J. Lynn Helms, president of Piper Aircraft Corp., an experienced combat pilot, a Marine on duty with the Air Force, a test pilot in his own right, and Mr. Paul Lovington, a representative of the engine manufacturer, Lycoming Division of AVCO, and Mr. W. A. Baker, chief engineer of Bristol Composite Materials, who developed the Enforcer's armor, already tested by the U.S. Air Force and acknowledged as outstandingly effective.

To give my friend, Gen. Jim Stewart, credit again, in his report he does give me credit for introducing this armor to the U.S. Air Force, and the U.S. Air Force cooperated in furnishing rounds for testing against 23 mm in Europe, and it was tested again at Wright-Patterson Air Force Base.

Now, Mr. Lovington on the engine and Mr. Anthony Baker will make brief presentations to show you that we are really dealing with a real-world problem, and then Mr. Lynn Helms, who is the president of the company which owns the project, will conclude our presentation. Mr. Lovington?

Senator GOLDWATER. Before we go further, do any Members of the committee or the staff have questions to ask of Mr. Lindsay?

Senator THURMOND. Mr. Chairman, I will ask some questions. I thought we would just let them present them and then get to the questions.

Mr. LOVINGTON. Mr. Chairman, I would like to give you a very brief rundown of the engine. I think there are a few points that I would like to clear up that have maybe been troublesome to people in the past in trying to understand the T55–L–9 turboprop, which is the engine in the Enforcer.

Now, the engine that we have taken as the base for the engine from which the turboprop is derived is the engine that has powered the CH–47 Chinook helicopter so successfully in Southeast Asia. This engine has seen numerous combat operations as the workhorse of the heavy lift of the U.S. Army in Southeast Asia, and we feel it is well suited to this type of operation. It has been under fire. It is well tested and proven.

Digitized by Google

Now, the engine itself, and I speak here roughly of the core engine, is what we base the entire turboprop program on. One area I would like to point out, since day one T55 series engines, has in the case of our smaller T53 series, are modular in design, and that modular capability allows us to adapt the engine to many different configurations, and without major change to the prime care.

One of the configurations, of course, is, as you see here, which is a direct drive shaft, and the direct drive is out at the front end of the engine. Here there is no reduction gear. Now, that inlet housing, which is the main structure here, was originally designed so as to take loads of the turboprop. That was from day one. That is nothing that we are just adding at a later date.

Therefore, when we got into the turboprop configuration, we merely removed that front linkage which, by the way, is the oil system for the direct drive engine, and replaced that entire package with a reduction gear, and that is this unit right in here, which requires a new cover plate, and of course an external oil system for the engine.

Now, in going that route, you eliminate the need for having to redevelop the basic core engine. We have applied this not only to turboprop but to turbofan. In fact, the A–9 that competed against the A–10 used a version of the same engine converted into a turbofan configuration. So, the approach to doing this job is demonstrated and proven, and in a smaller engine we have quite a few thousand hours of experience in the field. Risk is at a minium.

In this chart, you see that the base core engine in the T55 series has over 3 million flight hours. That does not include bench testing or running in the Lycoming test facility. That is all flying hours. I would say that about three-quarters of that time is in Southeast Asia. We have delivered over 3,500 engines of the T55 series. They are currently operating in the Chinook, which we saw in the first slide, and that is the Southeast Asia operation, which was combat. A version of the engine is also used in the Iranian Government's Bell 214 helicopter. Now, the Iranian Bell 214 is exactly the engine that we would use for a production version of the Enforcer.

In terms of other uses of this, we do have coproduction licenses set up in Italy in which the engine and the air vehicle, that is, the Chinook, are currently produced. We have the Chinook operating in Australia, in Europe, and in various other countries, including Canada. I think the widespread use of the engine is another very, very realistic approach to be considered in such a powerplant for close-support.

We have the engines worldwide in the countries that would require its use. In going to the turboprop, the T55–L–9 that powers the Enforcer has flown both in the Enforcer and, previously, in the North American YAT28–E. We have about 400 flight hours in that configuration, and in the smaller T53 that I mentioned, we have about 67,700 flight hours. These are all again operational hours, some of those in Vietnam.

I think from that you can readily recognize that experience on the configuration that we are talking about is well established. The T–53 model for the Army's Grumman "Mohawk" used exactly the same philosophy, taking a 53 core and using a gear system identical in configuration to that in the Enforcer powerplant.

Digitized by Google

Finally, I would like to say that in this slide we see the Iranian Bell 214. This powerplant is the one that forms the basis for the production Enforcer. We have on contract currently 415 of these engines. We have delivered 35 to Iran, and we also anticipate a follow-on order for in-country coproduction under license for another 500.

That same engine has operated in a gun ship configuration of this aircraft, which Bell had termed the King Cobra, and that was their approach with an interim version of an AAH—Advanced Attack Helicopter.

So, we feel that the T55 turboprop as the Enforcer powerplant is ideally suited for close-air-support. As Mr. Lindsay stated previously, the engine was well suited to moderate speed, low level operation. It has the greatest fuel economy of any class of engine in that area of operation. Thank you, Mr. Chairman.

Senator GOLDWATER. Thank you very much.

Mr. LINDSAY. We will now have Mr. Anthony Baker, who is probably suffering from whatever amount of jet-lag one gets from the Concorde, because he got in yesterday afternoon, just in time to join us last evening.

Mr. BAKER. Mr. Chairman, just two small corrections in what Mr. Lindsay has said. First, my name is Andrew Baker, and second, I was chief engineer at Bristol Composite Materials up to January last year. I have my own company in Britain, but because of the responsibility I had in the development of the armor, Bristol Composites asked me to speak for them on their account today.

This is Bristol armor as specified for the Enforcer. It comprises a ceramic front facing which breaks up the bullet and the resilient composite backing catches the bits. It is about half the weight of steel structure armor for the same performance.

Senator GOLDWATER. Could we see that when you are through?

Mr. BAKER. Certainly. I will pass it along now.

Against the more exotic armors like titanium, it has a similar performance, in some cases better, particularly against high explosive attack. The most significant point comparing it with titanium is that it is a little less than half the cost.

Senator GOLDWATER. About the same weight?

Mr. BAKER. The same weight for the same threat. There are variations in the performance. If it is a little down, in one, it is vastly superior, in our experience, in other connections. About the same in weight for the same threat.

Senator GOLDWATER. The outside pink is solid. Is that correct?

Mr. BAKER. No; that is made up from small tiles. In America, development of ceramic armors, which started about 1962, were concentrating on body armors for the protection of troops in Vietnam, and the tendency was to go to larger and larger plates of ceramic, one-piece plates of ceramic, to give the best performance against the sniper's bullet, one shot.

Now, we as structural engineers approached the matter from the other end. We were making structures which would have an armor protection quality. So, we went to smaller and smaller ceramic tiles, down to 2 inches, in some cases 1 inch in a section square, and looked around for the semblance of Michaelangelo, to be able to build them up into a mosaic and eliminate any weaknesses at the joints, thus provid-

Digitized by Google

ing the armor with a multihit capability, more like that of a steel or titanium armor, a metal armor, than what is normally associated with ceramic armor.

We guarantee 5-caliber shot spacing on our specifications. In many instances we can achieve 3-caliber shot spacings quite happily. Metal armor can come even closer than that.

Senator GOLDWATER. In making your armor for the aircraft, does it it have to be fabricated after manufacture, or can it be molded to the area that you want before it turns solid?

Mr. BAKER. We mold it to the shape required at a very great advantage. If it is a high degree of double curvature required, as around engine cowling, or a section of a fuselage, then we have smaller section tiles and we are able to go around the curve without any difficulty. That thin, small sheet that you see around the front of the armor can take up the little flex, to give you a smooth curve.

One other feature of our armor which you have just drawn attention to, really, is that it is a true structural armor. It can also be used as a parasitic armor, that is, an armored panel which is added to an existing metal structure to give it armor protection, and we sell a lot of our armors for protection of helicopters and aircraft in the United Kingdom and Europe in this way. But the most efficient way to use the armor is to make the actual structure of the aircraft from the armor material, and this is the case with the Enforcer.

The actual panels of the fuselage of the aircraft are made in our material, so you are therefore saving the weight of what would otherwise be metal structure. Thirteen panels comprise the Enforcer armor system, and they are all made to conform to the structure of the airplane and form part of the structure of the airplane.

Senator GOLDWATER. Have you tested this against the 23-millimeter?

Mr. BAKER. Yes, we have, both in the United Kingdom and in this country, at Wright-Patterson Air Force Base. This was a result of the last hearing.

Senator GOLDWATER. Will the 23-millimeter penetrate this?

Mr. BAKER. No. I can speak of specific figures, but perhaps it would be wisest to say that the armor that we are supplying meets the requirement for the defeat of the 23-millimeter AP attack and it will meet the high explosive attack at point blank range.

Mr. HELMS. Senator, I think he will show you some slides later showing even 57-millimeter tests against the armor.

Senator GOLDWATER. Fine.

Mr. BAKER. This really brings me to the first slide. This shows the range of structural armors which we have developed from very small caliber, that is, 30-caliber and 7.62-millimeter, up to 57-millimeter 2-pound weight antitank shells. The 23-millimeter is down the graph about halfway. The red part of the graph gives the performance of structural steel armor and the blue part of the graph here gives the performance of Bristol ceramic armor.

The point I wish to draw attention to here, Senator, in addition to the fact that we cover a wide range of threats is that generally speaking in every case we are about half the weight, the weight being down this side here, half the weight for the same armor performance compared with structural steel armor.

Digitized by Google

This is one of the early trials carried out in this country by the Naval Weapons Laboratory at Dahlgren on our 50-caliber armor. I would like you to note the date down here, 12th of October 1967, in the United States. The purpose was to put five shots into the panel here. The shooting was not too good, and three shots managed to hit the panel, one at the edge here and the other two within 2- to 3-caliber shot spacing, demonstrating a multihit capability.

Perhaps even more significant is the back of the panel. There is no spalling with our armor, as is often the case with metal armors. The metal armor will defeat the threat, but the back-spalling can do more damage than if the shell had actually gone through. This is a great advantage of our armor, particularly against the high-explosive attack. We do not get back-spalling. Next slide, please.

This demonstrates the multihit performance, all these little spots here being shots into this panel, and in addition, the way in which field repairs can be carried out very quickly on the armor, and you can be back in business in a matter of 10 or 15 minutes, as far as the armor is concerned.

This panel was repaired after having been shot in these two spots, a barnacle of the actual armor material being bonded over the spot where the previous shot had gone. Then, 10 minutes later, we shot onto the barnacles and demonstrated full protection.

This aspect of the armor's performance, I think, was also checked out against the 23-millimeter HE and API, the tests that were carried out at Wright-Patterson Air Force Base during this last year. Next slide, please.

This shows the other end of the range, the very small splinter protection against 1-ounce and 2-ounce splinters, carbon steel fragments. Again, Bristol armor is about half the weight for the same protection.

We found in the series of tests that against shrapnel these little carbon steel fregments are not really a true test vehicle. The piece of shrapnel goes flatwise onto the explosion, and really part out like falling leaves, in which case the performance is much better, but against these carbon steel fragments, we demonstrate 2-to-1 efficiency factor compared to steel.

I have graphs also showing the performance against hardened steel armor, and that is similar, a 2-to-1 ratio, weight to performance.

Here is the heaviest end of the range, the 57-millimeter 2-pound weight shells, both armor-piercing and armor-piercing ballistic caps. This is compared with noncemented steel armor and again it is about twice the efficiency, something less than that, I think. In fact, it is about 60 percent of the weight for the same protection. This armor we developed for the deckhouse of the aircraft carrier which Britain was going to build some time back, until Mr. Wilson sunk it without a trace.

Senator GOLDWATER. Let me ask you, are there any manufacturers any place in the world using this material for armor? I am very interested in this, because I remember it was the SR-70, I think, that was the first aircraft we built with plastic instead of titanium. In fact, it was so strong that a carbide drill would not penetrate. They had to use diamond drills, and it always made sense to me to use this—well, I was going to say plastic; it probably isn't that, but this type of material

Digitized by Google

for wing structure or fuselage structure where armor plating is desired.

Are any of the manufacturers that you know of using this instead of titanium any place in the world?

Mr. BAKER. I do not know of any place in place of titanium. We have looked at the requirement on the A–10, again, following the hearing before the Research and Development Committee here last year, and quoted them firm prices for the armor made in our material, and against a specification which we worked through, our armor is about 4 percent lighter in that airplane, and, we have reason to believe, less than half the price.

We are selling our armor very widely in Britain and in Europe for a whole range of applications, and in fact our ceramic face armor is just one of a number of armors that we produce, soft armors and transparent armors, in addition.

Senator GOLDWATER. What is your technical name for this material?

Mr. BAKER. We call it Bristol Armor.

Senator GOLDWATER. After your company?

Mr. BAKER. There are a number of people that developed this. We did it at our expense. It has not been funded by any industry or Government contractors. We ourselves manufacture the supply of it. There is no other structural armor made from these small tiles with this capability, as far as we are aware.

Senator GOLDWATER. Are you at liberty to tell what the chemical composition is of the armor?

Mr. BAKER. That is the one thing, sir, we withhold.

Senator GOLDWATER. All right. I don't blame you.

Mr. BAKER. We carried out some tests with the help of the Fort [Husted] Range in Britain to determine the shapecharge performance, the performance against heat rounds, and here we found that the weight of our armor is .38, or 38 percent of the weight of steel, for the same protection. This gave rise, then, to further tests at the Naval Weapons Laboratory at Dahlgren against the 57-millimeter standard HEAT round which you use here, and the result of that work is that they put out in a report that Bristol armor was the best armor they had tested, that is, the lightest armor, to defeat the dual threat of 50-caliber, armor-piercing and 57 millimeter HEAT round.

The remainder of these slides bear on the structural performance of the armor, showing how, no matter what you do to it, it still has a satisfactory ballistic performance. Here the armor has been stressed up to 50 percent of its ultimate strength, in flexure, and then shot at, and there is no deterioration in the armor performance. You have still got 100-percent ballistic performance after severely stressing the structure.

This gives the temperature performance, showing that from minus 30° C. up to 200° C., after 20 hours, still 100-percent ballistic performance. So, it meets all the environmental requirements from that point of view.

We had to do some other tests some years back to see what the effect of humidity environments would be, so we boiled the material in water for 3 days, and again carried out our shooting trials, with no deterioration in the armor performance.

Now, the Department of the Navy here was not satisfied with these tests, and I don't blame them, really, because no accelerated test really

Digitized by Google

simulates the environment in true fashion, and they took our panels and weathered them for 18 months, leaving them out in the open through deep freeze and thaw and weather and everything that you get in this part of the country, and then shot at them, and got the same results as the original panels gave.

We then checked for the performance under high-frequency vibrations, and we resonated the panels at 127 cycles per second, and again we had no deterioration or no damage of the panels.

Senator GOLDWATER. Theoretically, it should be impossible to damage this type of material, is that correct, by vibration?

Mr. BAKER. Well, you could get fatigue problems in a composite or in any structure, but breaking ground, you see, we were breaking ground with a new material, and consequently we had to test it very thoroughly from every point of view, and this is one point of view or one hole we have to fill. We had to make sure that it would not be susceptible to high frequency vibrations, vibrations where a panel of the aircraft, a wing or an engine cowling might vibrate in sympathy with an engine frequency, or something like that.

It had no weaknesses from that point of view.

This is just a handling or damage resistance test. This is a piece of armor on the way down, falling on its point onto a concrete floor. Next slide.

Here it is, and it shows that it can cope with this sort of handling without any problems, this very slight crushing of the corner and deformations of the corner, but with no significant deterioration of the panel at all, and the ballistic performance is completely unaffected. The tiles do not drop off or anything dreadful like that.

Senator GOLDWATER. Is the material brittle in nature?

Mr. BAKER. The base has very high strength, but very high stiffness, and this makes it forestall strain or failure, not like a piece of plastic. The ceramic surface, not like a piece of plastic, is a very brittle material.

Senator GOLDWATER. Does this have any similarity to boron epoxy test?

Mr. BAKER. Boron ceramic, yes, it is just a ceramic like we use ceramic. It is not the same ceramic.

Senator GOLDWATER. Do you feel this is much stronger than boron?

Mr. BAKER. We have found varying results with boron. It can give significantly higher single tile impact performance. It is not nearly so damage resistant as this armor, and far and away more significant to us is that it is much more expensive.

Senator GOLDWATER. That is a laminated structure, is it not?

Mr. BAKER. Yes; instead of using the type of tiles we use on the face of the armor, boron carbolated tiles are used. There are other types of ceramic that are used, and we make that sort of armor where required. They give a high performance for a single shot, but when we come to a structural application, such as we are speaking about on the Enforcer, we prefer to use this particular specification.

This is another damage-resistant test. This pointed rod here is dropped from various heights down onto the panel. Here you see the panel actually rebounding after the shock of the impact.

Digitized by Google

The next slide shows that again there is no deterioration in performance, except very close to where the actual impact has taken place, and then it has only deteriorated about 10 percent.

This slide shows the armor tested against the 23-millimeter API attack. There are two shots into the panel, and in this one we have actually caught the shell in the panel. That is the back end sticking out there. This demonstrates another feature of the armor, and we refer to it as a stop and contain armor. Up to angles of even 50° to 60° obliquity, the armor tends to stop the shot and contain it rather than the shot richocheting, and all our experience has shown that a ricochet can sometimes cause more damage than if it penetrated the armor.

The next slide shows the back of that same 23-millimeter round target, showing that there is no spalling at all.

Senator GOLDWATER. How thick was that?

Mr. BAKER. You have it, sir, on your desk. What is that, about 1½ inches?

Senator GOLDWATER. This thick.

Mr. BAKER. That is it. That is the actual armor specification of the Enforcer, and that is the thickness we show on this slide. I think that completes my part of the presentation, sir. If there are any questions. I would be happy to answer.

Senator GOLDWATER. Where are you located?

Mr. BAKER. In Avonmouth, Bristol, England.

Senator GOLDWATER. Where is that in relation to London?

Mr. BAKER. 120 miles west.

Mr. LINDSAY. Sir, in giving credit to the Air Force, it should be pointed out that one of the trips they made was to Bristol. Mr. Rall and General Stewart sent people over there, and they made a number of trips to investigate the claims I had made, which I thought was very fair.

Senator GOLDWATER. General Slay, are we using this material anyplace?

General SLAY. No, sir, we are not. Our tests show that the titanium armor, which is about half as thick for the same density, is better, and it is less expensive, about $5.67 per pound for titanium armor today that is going into the A–10, and our tests have been shown the ballistic capability of the titanium armor that we have in the A–10 is better than the Bristol armor.

We have the man that ran the tests here, if you would like to question him.

Senator GOLDWATER. How about the fabrication problems of titanium versus this?

General SLAY. Yes, sir, there is a problem there, but as the gentleman from Bristol said, you can make curved plates. As a matter of fact, we bought curved plates from Bristol to test. I think we paid $77 a pound for those curved plates. It is quite a manufacturing problem to make them. We have not run a detailed analysis on just what it would cost to make curved plates of the size we would need. However, I am sure it would be feasible to do.

Mr. BAKER. Could I comment there, sir? We were asked to supply panels to Wright-Patterson Aair Force Base to duplicate the tests that were carried out in England. We were rather reluctant to do so

Digitized by Google

in light of earlier experience we had in supplying panels for tests. So, for the first time, we made a charge for those panels to cover just the immediate cost of making up a small batch of sample panels. We were also asked to quote for the fabricated armor protection on the A–10. This was again as a result of the hearing before the Research and Development Subcommittee last year. This we did.

We sent our people across to Fairchild, and we quoted them fair prices against a quantity production run, and we have reason to believe that those prices were less than half what the current fabricated titanium armor unit is costing. It is not the cost of just a plain piece of material from which an armor assembly is made up; it is the fabricated cost of the assembly. That is what you are buying. You are buying the complete unit, and in designing any composite structure, the aim is to make that piece as far as possible in one bit, thus eliminating assembly costs which are so high when assembling an armor component from a number of smaller items.

Senator GOLDWATER. Thank you very much. Do you have any questions, Senator Thurmond?

Senator THURMOND. No; I don't believe I have any questions right now. Mr. Chairman, I believe the Air Force prepared a report on this, and the report indicates this armor would meet the requirements they claim for it, and I would like to put that in the record.

Senator GOLDWATER. Without objection, it will be placed in the record at this point.

[The "Evaluation of Bristol Armor, Interim Report," follows:]

EVALUATION OF BRISTOL ARMOR, INTERIM REPORT

The Air Force Flight Dynamics Laboratory conducted tests on the vulnerability of Bristol ceramic armor (Grade 300P). These tests were conducted from 19 June 1976 through January 1977. The threats used were 23mm API and HEI rounds. Approximately 60 rounds were fired against three basic types of Bristol ceramic armor; i.e., flat plate consisting of hexagonal ceramic tiles, flat plate consisting of square ceramic tiles, and dual curved panels consisting of square shape ceramic tiles. The tests were conducted to determine the threat impact velocity at which 50 percent of the rounds would be defeated (stopped) by the armor (ballistic limit, V_{50}). In addition, the extent of damage to the armor is determined in order to evaluate the difficulty of repair. It should be noted that damage occurs to the armor, whether or not the round is defeated. The results of these tests are as follows:

Bristol armor (grade 300P)	Shots	Ballistic limit, V_{50}	
		AFFDL tests	Bristol [1]
Threat 23 mm API:			
Flat plate (hex tiles)	6	2,012 ft/s	2,200 ft/s.
Flat late (sq tiles)	2	1,971 ft/s	2,200 ft/s.
Curved panels	2	1,955 ft/s	Not tested.
Threat 23 mm HEI: Flat plate (hex tiles)	1	Greater than 3,000 ft/s	Significantly greater than 2,300 ft/s.

[1] Bristol test No. 10–02–02, dated December 1974.

The remainder of the shots used to identify appropriate velocities at which to perform the V_{50} tests, characterize overall armor response, such as delamination of the backface fiberglass, and to determine repaired armor performance.

The extent of damage to the armor was about the same as anticipated. Bristol letter dated September 25, 1975, indicates damage extends approximately 9 calibers (diameters) from the impact point. The results of the Air Force tests have confirmed that this approximation is true.

Digitized by Google

Repair tests were made which showed that the original capability of the armor was restored, although the practicality of the repair technique for aircraft is not yet determined.

Mr. HELMS. Mr. Chairman, before beginning my formal statement, I would like to advise the committee that certain constraints that existed during earlier hearings at the time my biography was printed have been lifted by later information of the Freedom of Information Act. Accordingly, I wish to advise the committee that beginning in 1963, the largest group of non-Federal Government employees engaged in arms control, strategic analysis of armament, methods of determining strategic balance, the impact of strategic balance, the entire field of tactical or reconnaissance tactical target acquisition, target identification, location and attack, were all under my direction, and this continued until 1970.

My appearance here today is therefore with a background somewhat broader than that of a business executive or former test pilot.

We welcome this opportunity to appear and present our case in our own words rather than having had them interpreted by someone else. We have tried for 3 years to have such a hearing, and those 3 years have, surprisingly, served our case well. Almost universally the history of events during that 3 years has substantiated our initial position of the need for evaluating a smaller, heavily armored and very simple airplane, specifically for battlefield areas, close support of ground troops, but with the emphasis on lower cost by using older, well-proven airframe and engine technology in parallel with the most modern electronic and armament subsystems.

Simply put, our position is that a system is good, not because all the technology is spanking new, but because it is the proper combination of the very old, relatively old, and new, used in their respective application, with the attendant cost and reliability benefits. For those who doubt this, observe which of our new systems function without use of the wheel.

First, aside from the political and economic ramifications, to me the single most important event that came out of the so-called Yom Kippur war was the extremely high rate of material usage. In a nutshell, it was staggering. Unless one dedicates himself with some purpose to examine the conflict, it is difficult to comprehend that during that approximate 8-day period there were more tanks consumed than by both Rommel and Montgomery in their extensive campaign from El Alamein across North Africa. Other vehicles and airplanes suffered equally very high usage rates.

Even more spectacular is that the rate of usage appears to have been higher than either of the two sides ever encountered in World War II. This loss rate appears to have not been excessively one-sided; both sides suffered high material losses. Prudent examination clearly shows U.S. supplied equipment was not immune from this very high loss rate. Therefore, it seems to me this extremely high rate of material consumption forces us to take a new look at what kind of material and how much we can put into the field. More explicitly, this Nation may need another option—that of fielding smaller, cheaper, lighter units in greater numbers.

Digitized by Google

It appears that the tradeoff between armament capability, as opposed to armor, has shifted to offensive firepower. Specifically, it is now possible to put in the hands of troops or very little vehicles weapons of the type that have sufficiently high fire and penetrating firepower to penetrate the armor. I acknowledge I am not an expert on this.

Oddly enough, in some cases this armament capability by the one force was not highly accurate, specifically, for example, the Swagger missile, which is a wire-guided missile. There were just literally so many of them that when they missed, they could immediately fire another one. Once they came in contact they had a very good penetration. Therefore, the high rate of tank loss is primarily attributed to land combat and not air combat.

I believe that this Nation may need another option. The second major conclusion that I have drawn is, the program we are requesting has no technological risk as regards new developments. There are engineering improvements that can be made, such as those we have made in the succeeding 3 years, and specifically the armor. However, the use of technology in this instance has been to keep the airframe and engine simple and keep the cost down, while capitalizing on new technology subsystems for combat capability improvement.

I have read, or heard, comments to the effect that the Enforcer is old technology, that the airframe is essentially a World War II airframe design. I submit those observations are incomplete, and by virtue of that fact are inconclusive. Let me be more specific.

How does a 1977 rivet which is three thirty-seconds inch in diameter have greater holding power than a 1945 one of equal dimension? They are made with the same material and driven with the same tool. How have 1977 aluminum skins more strength than 1945 aluminum skins of similar dimensions? After all, they, too, are the same material. What has caused the aerodynamic equations of 1945 to now become invalid? These typical examples are what were used in the early 1940's and even late 1940's to design an airplane to operate in the 100 to 400 mph, or approximately 80 to 350 knots, airspeed range.

If these other items are obsolete, then how do those critics explain that the USAF studies to spec out a new close-air-support airplane come up with exactly the same speeds, approximatley 80 to 350 knots, and that speed range is not considered obsolete, as evidenced by the A–10?

Objective consideration clearly established that proper use of technology is to select that level that performs best for a given subsystem as part of the total system.

The aerodynamic equations of 1945 to operate in an 80- to 350-knot speed range are exactly usable today in that same speed range, and the airframe is clearly applicable. Objectively, I must acknowledge there have been new developments in aerodynamics. However, they do not nullify the past. It is the selection then of the proper level of other subsystems that establishes the total system level of capability.

It is an engineering fact that turboprop propulsion systems are more efficient at lower speeds and altitudes than turbojets and represent a significant forward step from reciprocating engines in propulsion subsystems to improve system capability.

Digitized by Google

The marriage of these proven elements with the latest electronic and firepower technologies is the epitome of proper use of our national technology bank. Acceptance of this fact is shown by the Department of Defense acceptance and use of what is probably the most successful battle area transport in U.S. aviation history, the C-130.

It is over 20 years old, and the production rate has been maintained. It will undoubtedly be in production close to another 10 or possibly 20 years. Why? Because the combination of the air frame design of 20 years ago and the propulsion system, a turboprop, are ideally suited to the mission requirement of subsonic flight at relatively low altitudes.

With the addition of modern avionics subsystems, and the new armor subsystem, which has been proven to be more effective than any armor now in use on any U.S. airplane, then the Enforcer starts to make sense, of marrying the respective proper levels of subsystem technology.

Third, we have never sought, and do not now seek, a production commitment or program. I do not believe we, as a Nation, and certainly our company does not, know enough about he survivability and operational feasibility of a light, cheap, heavily armored system to recommend a production program.

Equally, no one else in the United States knows enough to recommend against an operational test program. Despite the 2 or more billions of R. & D. dollars spent each year on aircraft development covering extremely high expenditures during World War II, the Korean War, and the Southeast Asian conflict, thereby totaling conservatively over $60 billion, the United States has never conducted field operational testing and in fact has never flown four turboprop close-support airplanes in formation.

As I outlined earlier, it is fairly well accepted that the turboprop propulsion system is the most fuel efficient and of later generation technology that can be applied to the area of close-air-support, a subelement of the total air warfare spectrum. This kind of propulsion system matches maneuverability, acceleration, and fuel saving characteristics that are ideally suited to the close-air-support role. Yet, as I said before, the United States has never flown four such aircraft in formation, much less explored the operational advantages in the battlefield arena.

It now becomes evident that we are talking of a machine primarily for close-air-support. To insure we are all on a common mental basis, I should briefly define the meaning of the term. The respective chairmen of the House and Senate Appropriations and Armed Services Committees wisely elected to have an examination of the subject, and chartered the Comptroller General to complete such a study.

Chapter 1, page 5 of the report very succinctly reflects the totality of the definition. The definition of the close-air-support mission, as promulgated by the Joint Chiefs of Staff, and concurred in by our Allies, is:

> Air attacks against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.

It specifically does not include area support, deep support, interdiction, deep interdiction, tactical penetration or other such terms.

Digitized by Google

One other short quote from that report is most pertinent to this hearing. Appendix II includes a discussion on close-air-support aircraft. In the interest of brevity, I will quote only the opening paragraph:

As the need developed for aerial support in Vietnam, it was soon established—

It didn't say hypothesized, it said established—

That, for the most part, the right equipment was not available. Most of the jets lacked effective guns and could not fly slow enough and could not stay long enough for most missions over the terrain. Because of the lack of suitable planes, all kinds of propeller-driven aircraft, such as the T–28 trainer, the World War II C–47 transport, and the B–26 bombers, which have a reasonable amount of staying power and payload capability, were pulled out of mothballs.

The ancient A–1 Skyraider, probably the most effective of the planes used for support in Vietnam, was borrowed from the Navy, and the O–1 Bird Dog was borrowed from the Army for revival of forward air controlling.

All of these are propeller-driven aircraft.

Collectively, then, the foregoing rather clearly establishes that the earlier referenced critic of the Enforcer's old technology spoke too soon, for the USAF in Vietnam did exactly what we are suggesting: they used proven air frame technology with new subsystem technology. We propose nothing more than to take a step further, using even newer subsystem technology.

Fourth, we have never, and do not now, suggest the Enforcer can or should replace the A–10. The A–10 was designed by the Air Force to meet a specific operational requirement, and we have never suggested the Enforcer should replace it or any other interdiction or close-air-support system. In fact, the only airplane yet to come into the USAF inventory specifically intended for close-air-support is the A–10. We believe this Nation needs the option of a backup if the concept of a light, cheap, heavily armored system proves feasible.

Both the Congress and the Department of Defense have echoed the desire to reduce the cost of weaponry. Our citizenry is demanding it. A potential opportunity exists to greatly relieve the U.S. taxpayer burden by the use of light, heavily armored, and cheaper systems. It is not enough for a department to say they do not have a requirement, and show as proof that there is no staff paper to establish the S.O.R.

I submit there was no staff paper for the atomic bomb, the jet engine, or the Salk vaccine. The staff paper was written after proven balancing of various technologies indicated that each could be achieved, and should be undertaken.

While it would be fallacious, or at least precipitous, to suggest a production program, it is an equal folly in the absence of one single operational test report to say, "I do not know the answer, I do not want to know the answers, and I will not conduct tests to find out the answers."

Fifth, the test program we are seeking is intended to provide factual data on operational suitability and survivability, not design verification. Military science in its most simplistic terms is a game of one-upmanship; an increment better in quantity, training, material, mobility, tactics, et cetera. The spectrum of conflict we must consider requires material from one case of pistols to the other extreme, of the B–1 or Trident.

Digitized by Google

As each step is taken from a lower level to the next higher, pistol to rifle, to mortar, to artillery, to X, Y, to Z, the two parties involved escalated the conflict to a next higher level. We as a Nation must be capable of either responding or giving the President and Congress the option of committing to the appropriate level.

At inappropriate hardware levels, the U.S. commitment may get out of control. For example, we can furnish combat helicopters, or combat vehicles, but from there where do we go? Only to jet aircraft, with advanced and complex electronic systems. Those will probably require U.S. military personnel on site to train personnel or maintain the vehicles. The United States has then no interim option, and once U.S. personnel are committed to foreign soil, the spectrum of conflict potential for the United States has been dramatically escalated.

Evidence of this is worldwide. Recently, I was in Cairo and was told by an embarrassed Egyptian that the helicopter given by former President Nixon to President Sadat has never flown. It is now unsafe. They do not know how to maintain it. That, of course, is not even a combat vehicle. Egypt has more engineers than all of the rest of the Islam world combined.

I submit the United States needs another option, one of being able to convey a simple option to support the combat needs and that system so simple that it does not require U.S. personnel for maintenance.

Earlier tests conducted on the Enforcer at Eglin Air Force Base and separate USAF analysis by the Aeronautical Systems Division and the Naval Air Systems Command have confirmed the airplane meets the designed claims. However, analysis from that point on has been by computer, and I submit such data, while extremely valuable, is nevertheless susceptible to individual subjective inputs into the computer program and that the results tend to project conclusions in an area where no real, valid, documented test results exist.

Put another way, the computer can go so far, but you then need to put a pilot's eye behind the gun sight and his hands on the controls to do a meaningful evaluation. Factual support of this view is evidenced by the recent Day Fighter competition, which resulted in two outstanding airplanes, where before we had neither. Only hardware evaluation will provide the factual data to enable decisionmakers to make informed decisions. Such tests for a close-air-support program can be accomplished far faster and cheaper by use of the Enforcer than any other aircraft, because it is the only aircraft now flying, with additional hardware presently available to build four airplanes for full field operational testing.

All of the earlier design and testing have been funded by private capital, and that does not include overhead allowance on other Department of Defense contracts. It was purely private capital. There was a time in our Nation's history that we encouraged private investments to develop our Nation's military needs, and rewarded those people with test funding.

The foregoing then summarizes the key elements of why we consider the requested operational testing programs so vital. We see this as an extremely austere program with a small project group set aside solely for this purpose. No extensive drawings, documentation, procedures, et cetera, but just enough to do the job and make sure we can validate the configuration.

Digitized by Google

To those that may be skeptics, such an approach has been followed by general aviation companies for some 40 years, and today the U.S. general aviation industry supplys 90 percent of all the world's general aviation products. Renowned worldwide for their reliability and flexibility of usage. This includes turboprops and pure jets: Therefore, there can be little doubt as to the effectiveness of the system and the level of technology involved. Our industry position in the world marketplace is factual evidence to support that statement.

Since we are primarily interested in operational testing, both time and money will be saved by putting the program near the best government site to monitor the program. We believe the Naval Ordnance Test Station at China Lake, Calif., has been outstanding in development of external ordnance and the attendant operational testing for close support weapons. With full test ranges available, and an excellent technical staff, we believe that agency is the ideal government monitoring agency, and we would locate our small project team close by. Such an effort would provide the earliest possible verification of feasibility for the Nation to have an option, and I stress the word option, the light, cheap, heavily armored, easily deployable aircraft which may have a role in the high material usage environment of today's warfare.

As Mr. Lindsay stated earlier, the existing Enforcer prototype has been turned up weekly for some years. Two years ago, we changed the battery. That is the only maintenance that has been done to the aircraft.

As another alternate, we believe the U.S. Marine Corps has more experience and knowledge of the interrelationship between air and ground than any other U.S. or worldwide military service. That organization could run an equally objective operational test program.

The identification of these two in no way shows a lack of confidence in the U.S. Air Force to run such a program, but reflects both organizations' historically closer relationship for tactical weaponry and close support.

Close air support is the dirty part of the aerial warfare spectrum. It is totally unproductive unless ordnance is delivered on a target. This usually requires lower altitudes at slower speeds than the jets operate. Pilots just plain do not like it. It obviously exposes the machines to extensive ground fire. However, the combination of the experience and the application is one reason the Marine Corps does it so well. With a lower I. R. signature than any other U.S. close-air-support aircraft flying, with more effective armorplate than any other U.S. close-air-support aircraft flying, and with a smaller size than contemporary machines, it is clearly evident the survivability of the Enforcer should be higher than other aircraft.

To not operationally test such a machine is to deny the foot soldier the needed close air support and the aircrews the greater possibility of survival solely by opinion.

The Maginot Line was conceived by the same mental process. Such an option can be confirmed at very low cost.

We recommend a four-plane program. This would allow pilots to fly operational missions in a four-plane element, a standard in today's

58-379 O - 77 - 34

Digitized by Google

force structure, and thereby evaluate the full spectrum of field operation, including self-defense against air attack. Such a program would take 24 months and require new authorization funds of $10.6 million. That is the total design development, fabrication, flight test, and operational test cost. Some use of persistently existing warehoused, inventoried equipment would also be used, specifically the engine which is used in the Army Chinook helicopter and the propeller used by the Navy's Skyraider. As you learned earlier, the engine is in production, funded by the Government of Iran.

Finally, while I note that we are not seeking a production program, some discussion on production cost is in order to establish that the airplane is representative of a production vehicle that could be fielded. I frankly do not know the formula for and do not understand the system of devising various definitions of program cost, but I know one point as well as anyone. That is unit flyaway cost.

Our company builds thousands of airplanes each year, and we specifically track that point. I can tell you the cost of every airplane that comes off that line the day it comes off that line, and today Piper has in production an airplane that has two turboprop engines—the Enforcer has one—has a pressurized fuselage—the Enforcer does not—and other such comparisons that can be made with our Cheyenne capability.

Last year I personally flew the Cheyenne to 26 nations around the world. It has the same range capability that we are talking about for the Enforcer. Its speed is over 300 miles per hour. We sell that aircraft for approximately $660,000, depending on each customer's specifications of electronics equipment, and we make a profit.

An extensive analysis of production cost has been conducted, and I will submit separately the summary of these costs for use by the committee. There is no doubt in my mind that we can build this airplane, the Enforcer, and have it fly away for well under $1 million each. Specifically, our detailed analysis shows a flyaway unit price of $902,000 in a quantity of 700 airplanes.

Mr. Chairman, at no time in any prior hearings, in any technical reports, in any presentation, in any press reviews, in fact, in any way, have we ever recommended, suggested, or implied a comparison should be made between the Enforcer and the A–10. Despite that, on every occasion, when asked about the Enforcer, the USAF has each time responded with the A–10, and in the last hearings submitted a detailed comparison with their conclusion, based on their comparison methods.

As presented, their data purport to show an improved cost effectiveness for the A–10 over the Enforcer. While I regret having to do so, I am now forced into such a comparison again, but this time I will do it. To remove from the committee's mind the need to make detailed technical judgment of the opposing views, I will use the USAF's own charts. In all cases, I will accept those fundamentals, and use only Piper charts in an area of elaboration.

We can eliminate any discussion on performance as both the USAF and Navy studies concurred that the Enforcer would meet essentially all of our claims. Some minor differences existed but the USAF also

Digitized by Google

agreed they were incidental and rather easily corrected. This is contained in the ASD study conducted by the USAF which was reflected earlier and establishes general agreement, as regards airplane performance, between the design team and the government agencies.

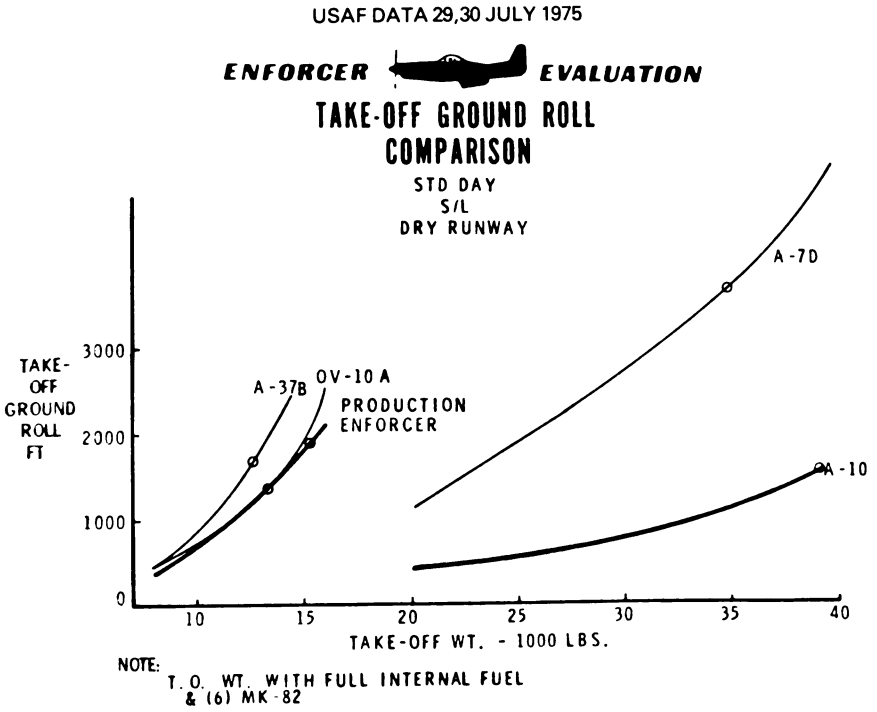
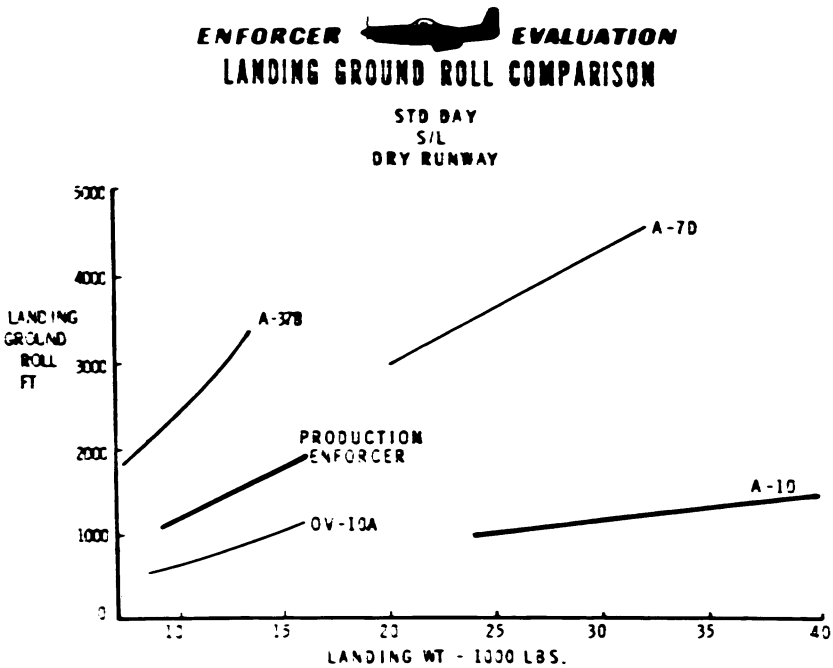


CHART 1

Therefore, the crux of the question is operational performance, and and even that can be narrowed down to two Air Force conclusions, which I will show are in error. The first chart, slide No. 1, is a takeoff ground roll comparison, and compares the A–37B, the OV–10A, the Enforcer, the A–7D, and the A–10. The chart shows the load carried of 6 MK–82 bombs, or 3,000 pounds of external ordnance, and shows the Enforcer and the A–10 are very comparable, under 2,000 feet of ground roll. However, also note the chart specifies it is on a dry runway, and second, that carried to the extreme of both aircraft and weight. You will note that the A–10 weight is 39,000 pounds, all the way to the right side of the chart.

Digitized by Google



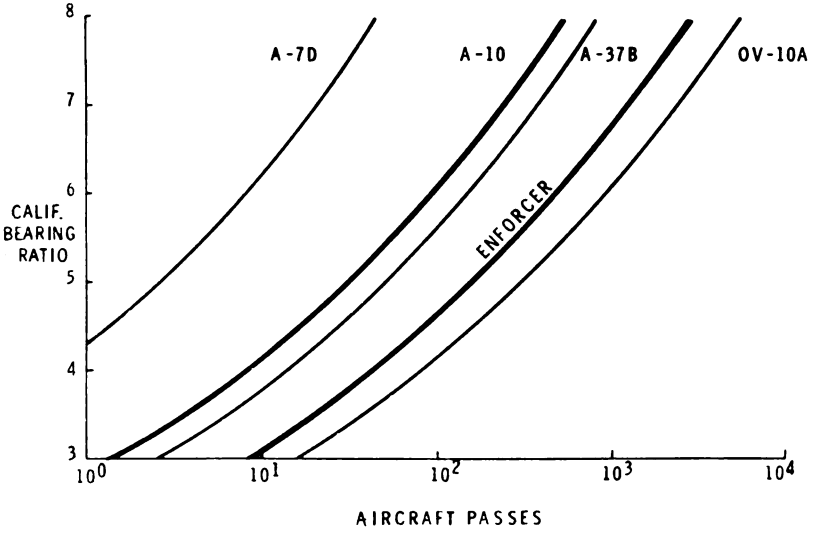
The second chart, slide No. 2, shows similar comparisons for a landing ground roll, and again the Enforcer and the A–10 are roughly comparable, except that in both cases while the 3,000 pounds was carried, one aircraft weighed barely over one-third the takeoff weight of the other, and both landed in essentially the same distance. Again, these charts show that for carrying 6 MK–82 bombs, or about 3,000 pounds, the Enforcer would weigh only slightly more than one-third the A–10, and they will have generally comparable takeoff and landing distances.

Digitized by Google.

USAF DATA 29,30 JULY 1975

ENFORCER EVALUATION

FLOTATION CHARACTERISTICS FOR 6 MK-82 CONFIGURATION



The third chart, slide 3, shows the flotation characteristics for the same 3,000-pound load. Again, these are all Air Force charts, presented by them at the R. & D. Subcommittee hearings. This is a general way of comparing nonrunway capability, but only to the extent of weight and tire size. The use of what is referred to as the "California bearing ratio" is an accepted criteria for such measurement, and as an example, a California bearing ratio of six can be equated to a good golf fairway.

Lower numbers mean softer surfaces like sand and mud; higher numbers mean harder surfaces, like dry clay, for example. For a bearing ratio of six on this chart, then, the A–10 could make approximately 90 passes, while for the same ratio, and carrying the same bomb load, the Enforcer could make approximately 650 passes.

This draws one's attention to the chart immediaely, then, and says, no, it is not that much, but if you examine the testimony, you will note that the Air Force in this chart did one thing differently. It carried all the values to the value of 10 at the bottom. So, it is 10 to the first, 10 to the second, and 10 to the third power, not 10, 20, or 30.

Examining these curves, then, shows that when the A–10 made 90 passes, the Enforcer for the same condition made 650 passes. Again, I ask the committee to keep in mind these are not my charts, and I didn't make them. They were prepared by the USAF and may be found in the report of the Senate Armed Services R. & D. Subcommittee hearings of July 29 and 30, 1975.

Digitized by Google

Continuing, then, let's take an even more important case. Choose a messier environment, say, a ratio of four, which is soft sand, or mud more likely to be encountered. At that point, the A–10 could only make approximately 9 passes, while the Enforcer could make approximately 50 passes.

Simply put, this means the A–10 under these conditions could fly approximately 9 sorties while the Enforcer could fly approximately 50 sorties.

Mr. OLD. Mr. Helms, may I ask you a question for the clarification of the committee at this point? Would you please go to the chart and point out the examples that you are reading to us so there is no doubt as to what the point is?

Mr. HELMS. Very good, sir. The California bearing ratio of six was the first example I chose, and that is roughly equivalent to a golf course. That is the Air Force testimony in the last hearings. If you come across here, then, to the A–10 curve, and come down, you will see 10 to the squared, which is 100, and it is right along in here, so rather than nitpick, I rounded it off at about 90 passes.

If I do the same thing, bearing ratio 6, and come across to the Enforcer curve, and come down, this would be halfway between 10 to the half and 10 to the cube, which is 1,000, and if I come down again from a bearing ratio of 6 to here, I get about 650 passes. I then chose a messy environment, four, which is relatively poor environment in Europe. As a matter of fact, in bad weather that is probably more likely. If I go to that same curve and come down, I see about 9 sorties could be flown by the A–10, but if I stay at 4 and come across to the Enforcer, I come down, 10 squared is 100, and I come down at about 60, and those are the 2 data points I extracted from their curve.

Mr. OLD. Yes, sir, and your complaint is that the chart is not inaccurate, but the chart does not reflect clearly enough the comparison between the two aircraft.

Mr. HELMS. You could put it that way, but thus far, I have not made a complaint. It is when I get to my conclusions later. I want to show the committee that by using the Air Force charts, you have been given very, very misleading information, but I want to use their charts so there is no question that I derived the data.

Mr. OLD. I was just trying to determine if the chart was in error.

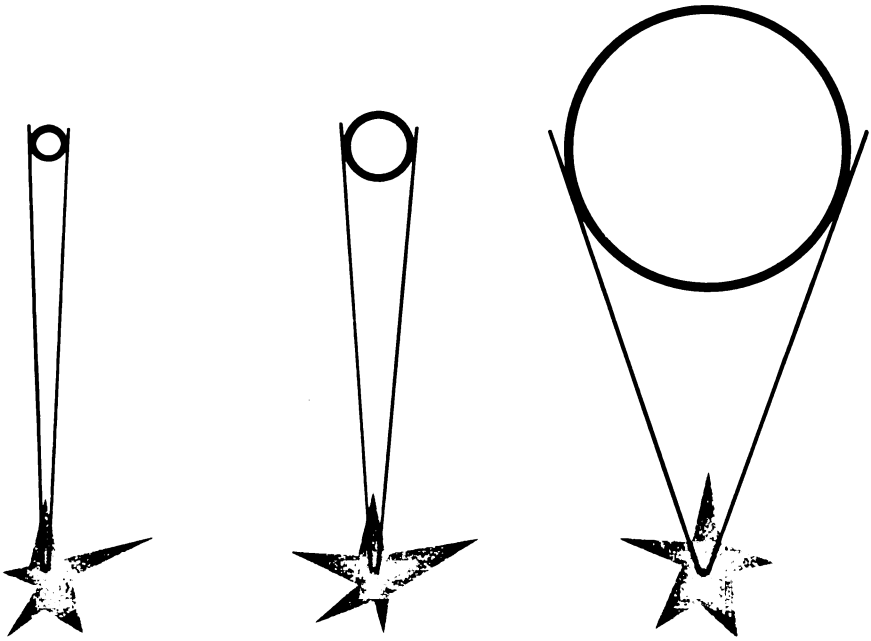
Mr. HELMS. I have no way of knowing. I doubt it. No: I don't think the chart was in error. That is just my opinion. I don't think they would bring a chart in that is in error, as such.

Continuing, then, survivability or its partial reciprocal, vulnerability, whatever the terms, we know that the combination of the probability of being hit plus the probability of being killed if you are hit is the lowest common denominator. USAF testimony shows exact agreement with us that Hp, which is the hit capability, plus Kp, which is the kill probability, equals survivability, and this is the classic definition. It is easier to hit a cow with a rifle than it is a hummingbird. However, the two were in different environments. One was on the ground, probably still; the other was in the air, moving in three dimensions.

Digitized by Google

If I substitute a still mouse for the hummingbird, I then have established like with like. Both are four legged, both on the ground, both still, and both with a long tail. Again, the cow is much larger, and therefore has the far greater probability of being hit. Therefore, the Hp or hit probability is the first part of the comparison.

HIT PROBABILITY -VS- SIZE



The next slide shows this more graphically. This is a Piper slide. If I have a given round of ordnance, explode a given distance from the target, the smaller body on the left has the smaller subtended angle of shrapnel vulnerability, with the middle one more likely to be hit, and finally, the larger one on the right would have the highest probability of being hit.

Simple trigonometry then absolutely confirms that for a given explosive charge with a given shrapnel loading and at a given distance, the fact that the A–10 is approximately two times as large as the Enforcer automatically results in its having approximately two times the probability of being hit.

For clarification again, I am not yet discussing whether it would have a greater probability of being killed, only that for a given air defense it must have approximately two times the probability of being hit.

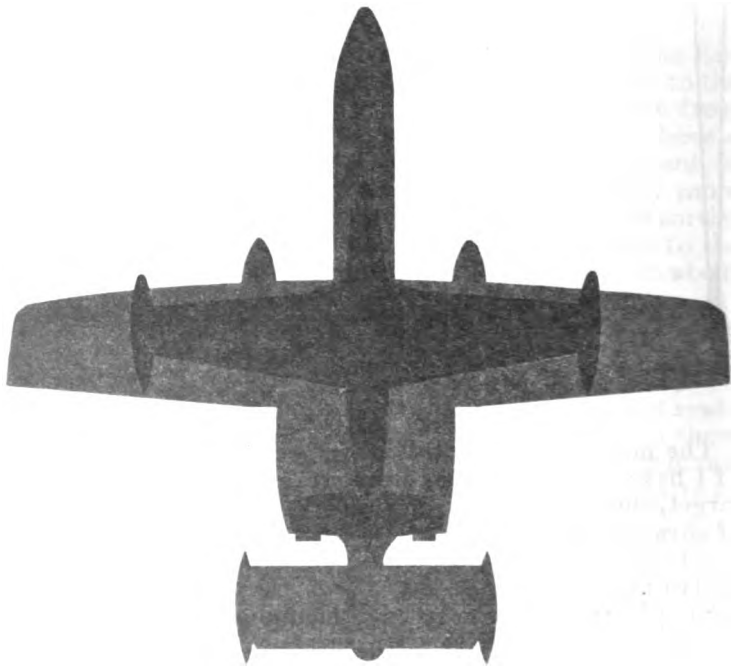
Hit probability is primarily the function of speed, size, tactics, and signature. The A–10 and the Enforcer have the same speed range, can use the same tactics, would have the same pilots, and therefore their respective probability of being hit reduces to two items, size and signature.

Digitized by Google

As noted above, size works approximately 2 to 1 in favor of the Enforcer. Remember, from earlier charts, they were both carrying the same 3,000-pound payload. Since the most dominant aspect of radar signature is target cross-section, the much larger A–10 would logically create a much larger radar signature. I acknowledge this is not always the case, as angles in the geometry affect the result, but in order that I may stay with fundamentals, I will not be very far off with two subsonic systems of approximately equal speed capability in concluding radar signature is a function of size.

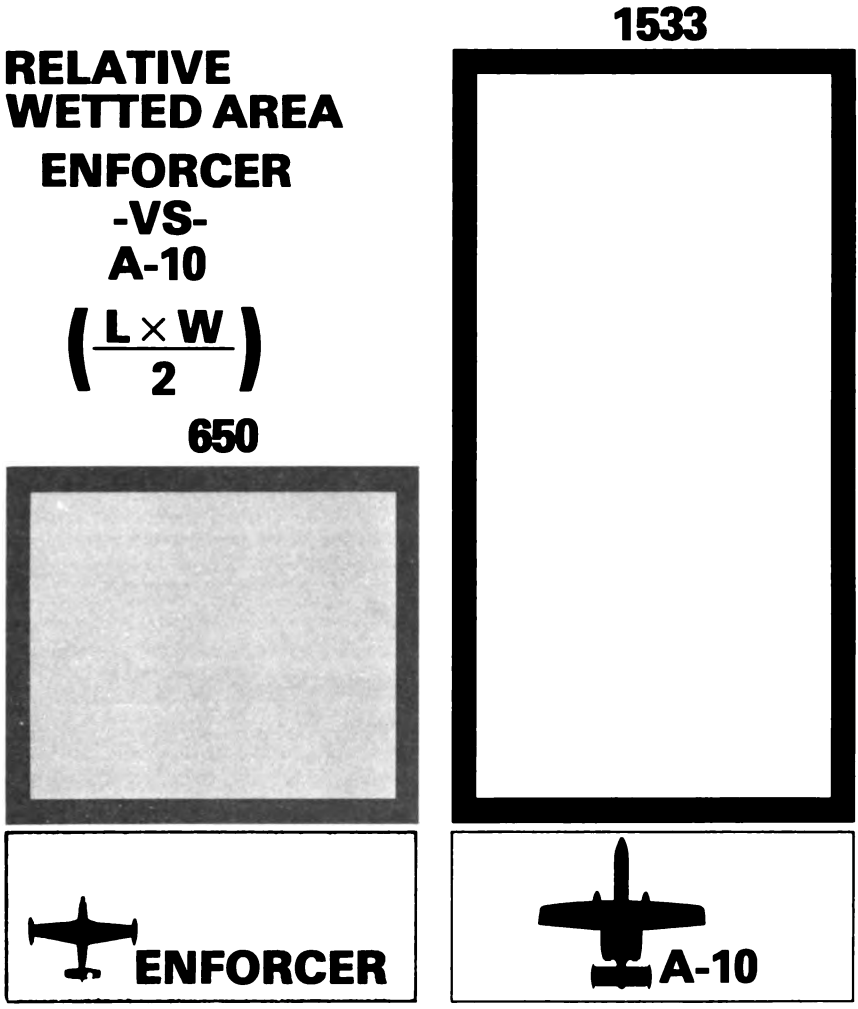
Therefore, again, the A–10 has a greater probability of being acquired, being tracked, and being pursued by radar weapons, missiles. Both the A–10 and the Enforcer can carry ECM pods, and the earlier described performance data would be jointed affected by these pods. The point is, both can carry them.

RELATIVE SIZE IN PLAN (TO SCALE)



Slide No. 5 shows the relative plan size view of the Enforcer and the A–10. This drawing is to scale. The much smaller size of the Enforcer is readily apparent. To give you a more factual basis for comparison, however, the next slide, No. 6, uses a classic method of length times width divided by 2 to establish relative areas.

Digitized by Google



Some may say that approach is not sufficiently accurate, but it does do two things. If there is an error, it is applied commonly to both. Therefore, the relative impact is zero. Two, it gives the A–10 an advantage, since the engines of the A–10 are outside the air frame, and therefore, since their diameter alone is larger than the entire Enforcer fuselage, contribute to larger wetted areas that do not reflect in this very simplified equation, and even with that advantage to the A–10, we see the Enforcer is much less than half the size of the A–10.

Since both airplanes are of subsonic design, they do not include the sharp angles necessary for shock wave compatibility, and therefore have generally equal representation of angular impact from radar signals. Despite the fact that radar return signal strength is not exactly

Digitized by Google

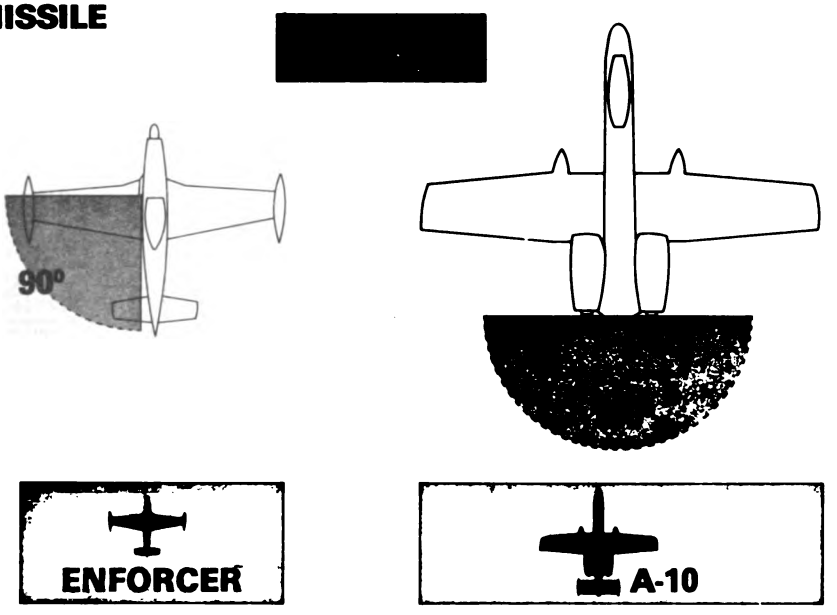
a straight line with size, and that the A–10 has many more major protuberances to increase the radar signature, twin large verticals, twin external engine pods. We have simplified it solely to size, which results in a radar return of less than one-half for the Enforcer as compared to the A–10.

After visual size and radar signature, only one signature consideration remains. That, of course, may be the most meaningful of all, the IR, or infrared, signature from the heat of the engines. I am purposely ignoring the acoustic signature, which would be dramatically smaller in the Enforcer, and is not truly applicable here.

The next chart, slide No. 7, is of the Enforcer in flight, to show the physical location of the engine exhaust, one single outlet located above the leading edge of the left wing, in the propeller slipstream, which immediately upon exhaust dilutes the heat element, and is easily receptive of louvres or baffles. Remember, the turboshaft or turboprop engine has already extracted its energy from the combustion process at exhaust; therefore, its temperature/velocity characteristics are far lower than a jet engine or a turbofan engine.

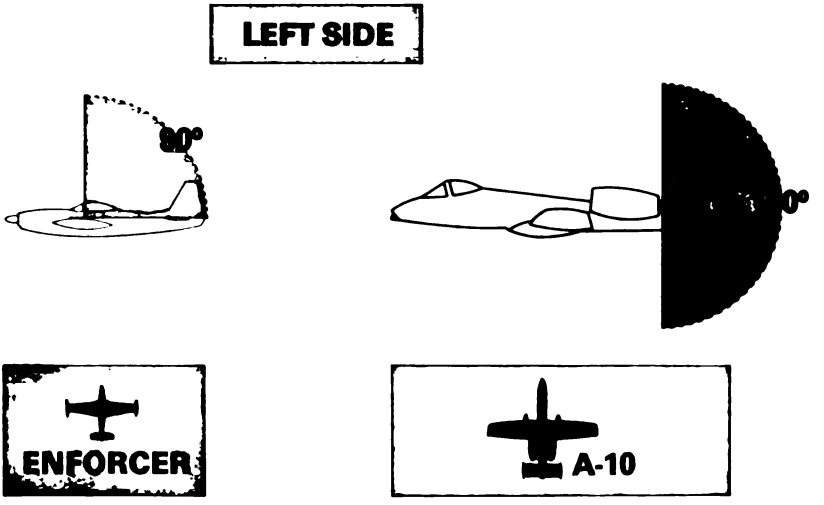
Digitized by Google

RELATIVE POTENTIAL INFRA RED HEAT SEEKING MISSILE



Slide No. 8 shows the top view of the two airplanes, and shows that the A–10, with its two jet engines, has 180 degrees of IR potential, that is, engines exposed for IR secret missiles. I will make a comment later on this approach to the analysis. The corresponding Enforcer angle is 90 degrees, with the fuselage blanking out the right side. In this mode, then, the Enforcer has one-half the IR angle potential.

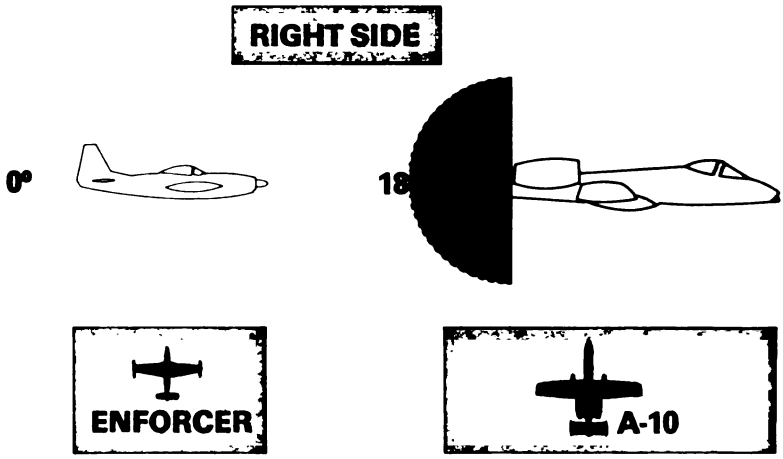
RELATIVE POTENTIAL INFRA RED HEAT SEEKING MISSILE



Digitized by Google

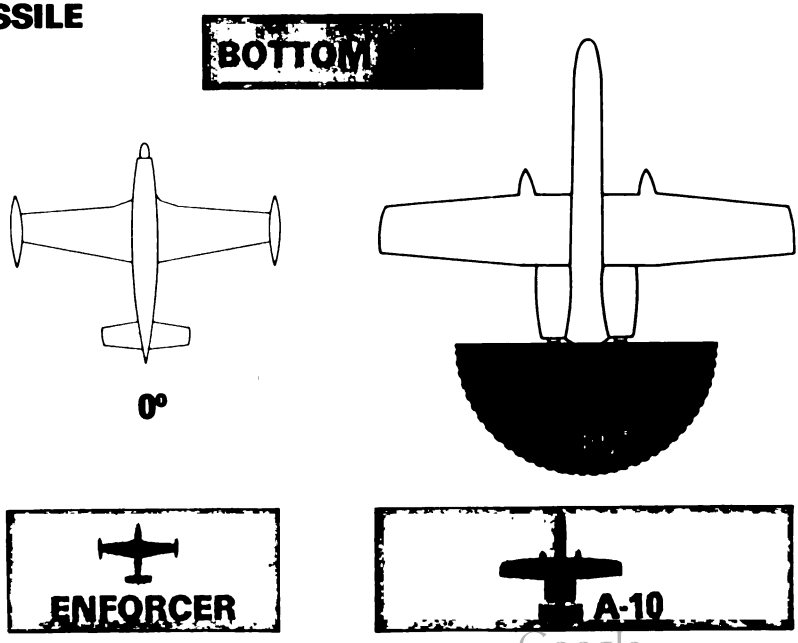
Slide No. 9 shows the left side of the two airplanes, and again, the engines of the A–10 result in 180-degree exposure, whereas the wing blocks the Enforcer from below and again results in only 90 degrees IR potential.

RELATIVE POTENTIAL
INFRARED HEAT SEEKING MISSILE



Slide No. 10 shows the two from the right side, where again the A–10 has 180 degrees, but in this case the Enforcer is zero. The fuselage completely shields it.

RELATIVE POTENTIAL
INFRARED
HEAT SEEKING
MISSILE



Digitized by Google

Finally, slide No. 11 shows the plan view from the bottom, where the ground launched missile comes from. Here, again, the A–10 is 180 degrees and, again, the Enforcer is zero, shielded by the wing.

If I give the A–10 a value of one for each view and the corresponding Enforcer value, I end up with a summation that compiles as follows: On the top, the A–10 equals one; the Enforcer is one-half. On the left side, the A–10 is one; the Enforcer is one-half. From the right side, the A–10 is one; the Enforcer is zero. From the bottom view, the A–10 is one and the Enforcer is zero, a total of four for the A–10 and one for the Enforcer, or an infrared factor for the Enforcer as regards angle availability equal to four times better than the A–10.

Earlier I noted some may question the method, but none will question that the exhaust of a turboprop engine, dispersed by propeller slipstream, and shielded by louvres, is even more than one-fourth less than whatever reduced subtended angle or penetration temperature profile is selected for the twin jet podding configurations.

Gentlemen, it is fundamental physics.

Therefore, as regards the probability of being hit, the Enforcer has less than one-half the size, has one-half the radar signature, and one-quarter or less the IR signature. In a given random environment of antiaircraft artillery, radar missiles, and IR missiles, the Enforcer will have considerably less than half the probability of being hit, and mathematically, closer to a third.

USAF DATA 29,30 JULY 1975

ENFORCER EVALUATION

COMPARISON OF RELATIVE A-KILL VULNERABLE AREA (FT^2)

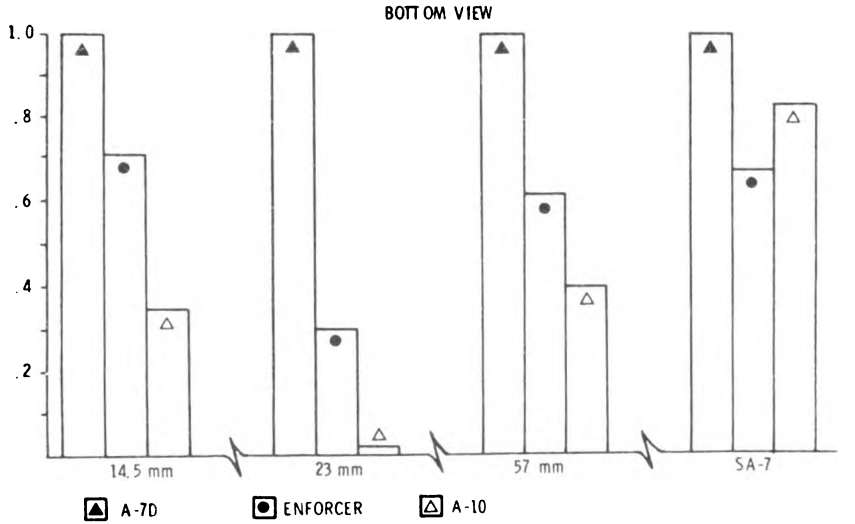


Chart No. 12 was presented to the Senate R. & D. Subcommittee as a basis for attrition in the Air Forec computer model. Again, this is an Air Force chart. It completely ignores the probability of being hit. In fact, their testimony acknowledges that the chart presented

Digitized by Google

did not reflect hit probability. Even more to the point, read the heading on this slide carefully. It is not my slide. It equates vulnerability, which, by their definition is only one-half of the survivability equation, to square footage.

Note the parenthesis. We have already seen the A–10 has over two times the wetted area, but some way this is forgotten.

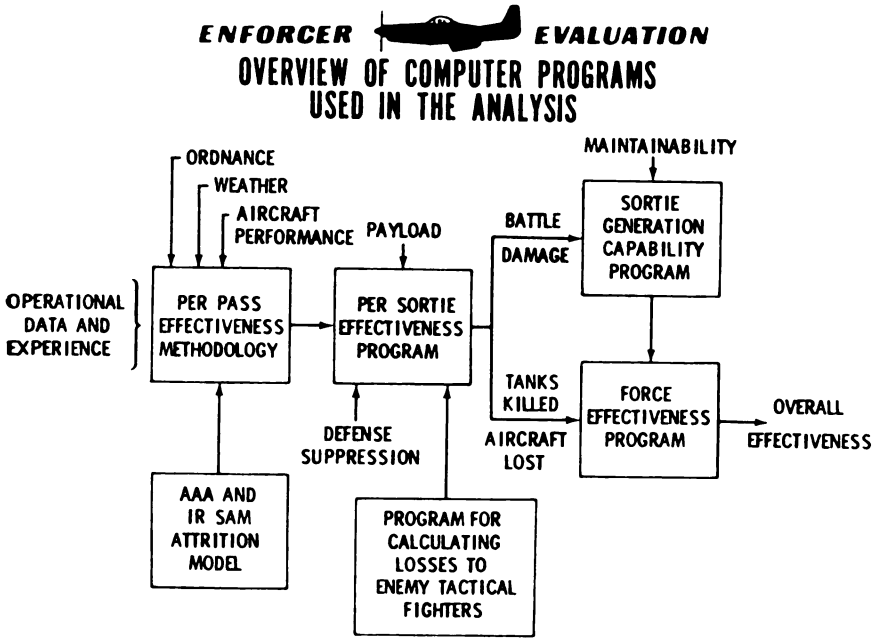
Now let's take this a step further, and presume this is meant to be the square footage of only certain selected areas that are considered vulnerable. In general, whatever is vulnerable on one airplane is obviously vulnerable on the other. The A–10 has two engines, hence two times the vulnerability square footage, et cetera. Therefore, it is axiomatic that for two airplanes of the same size, with the same vulnerability area, then the same amount of armor would give them the same protection, or they would have the same vulnerability factor.

If one of them was one-half as large, and had one-half the vulnerable square footage, but also had one-half the armor, then they would still have the same protection factor, but if the smaller airplane, less than half the size, and with less than half the vulnerable square footage, still had the same armor weight, it would then have a mathematical twice as high as such protection. If both had 1,500 pounds of armor protection but the smaller airplane only spread it over less than one-half the area, then its vulnerability to fire would be one-half, and that is exactly the case in the A–10 and the Enforcer. Both have 1,500 pounds of armor, yet the USAF presented a picture to show the A–10 was less vulnerable, which is, of course, erroneous.

The USAF stated on page 94 of the R. & D. subcommittee hearings the classic definition of survivability, probability of being hit plus probability of being killed, if you are hit. The Air Force did not show this on this chart or any other charts presented to the subcommittee.

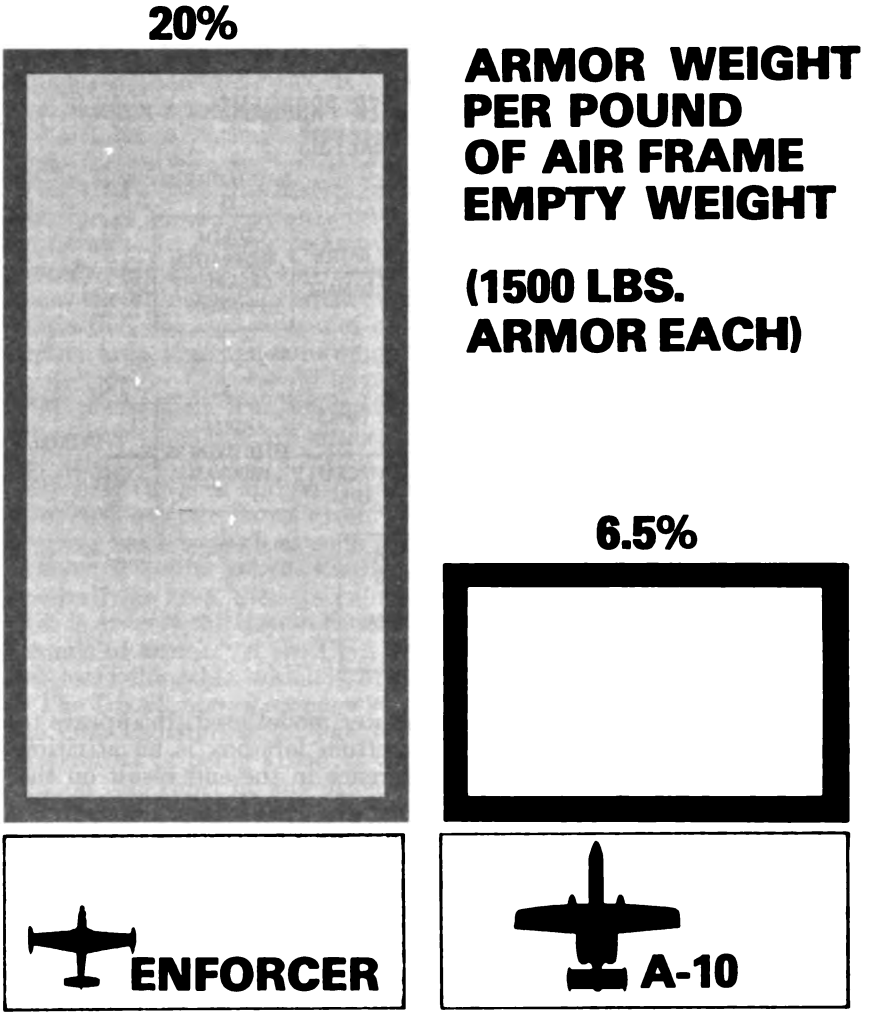
I have just shown the Enforcer has one-half the probability of being hit and one-half the probability of being killed using their method of square footage of vulnerability. It is therefore possessive of two times the survivability of the A–10. As regards, then, computer models, intended to give you force effectiveness, an attrition model which derived whatever mission requirements established the requirements for the A–10 aircraft, and 504 were used by the USAF, then those same missions could be performed with 252 Enforcers with equal attrition.

Digitized by Google



Slide No. 13 shows the USAF computer model used. It appears to be a generally accepted model. The bottom left box is an attrition model and would make a drastic difference in the end result on the right for overall effectiveness if it showed more Enforcers required than A–10 aircraft, and by quietly forgetting the probability of being hit, which they acknowledge was not included, and ignoring the armor-to-weight-empty ratio, the output of the model became meaningless, and was directly misleading to this committee and the Congress.

Digitized by Google

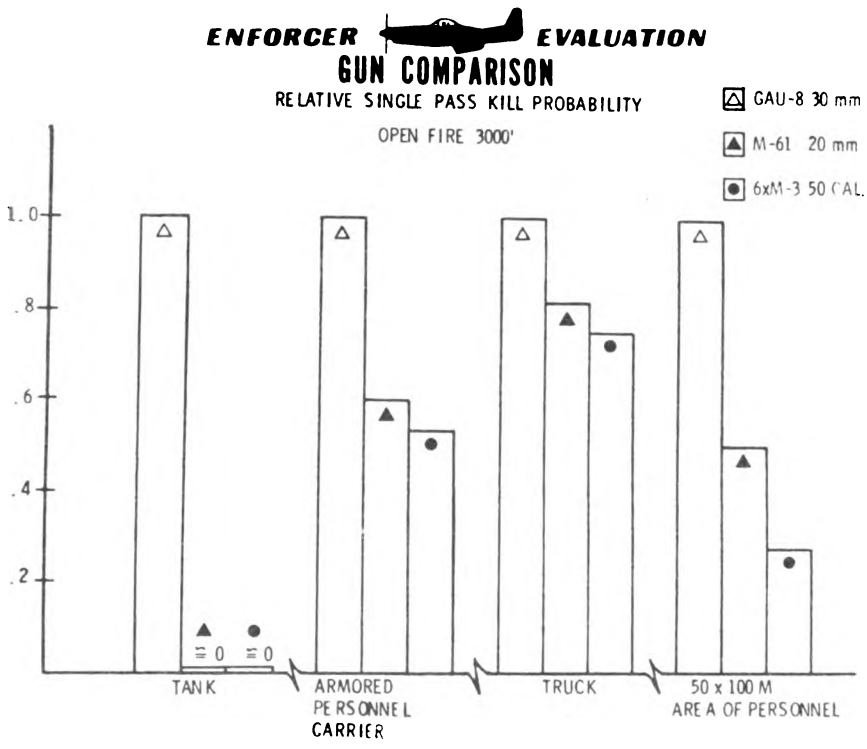


For those who are doubters, the next slide, No. 14, shows the actual value of armor percentage to weight empty, using the 1,500-pounds of armor over the two airplanes. Twenty percent of the Enforcer weight empty is armor, while only 6.5 percent of the A–10 is armor. Even if I am off, I could not be off far. Is there any question which has the higher potential as regards vulnerability, particularly when dual hydraulic lines run to every external control surface of the A–10 and none due to the Enforcer?

If I use the direct math ratio, that is, divide the 20 percent by the 6.5, then the Enforcer would be three times as effective. I chose the more conservative approach as previously outlined.

Accordingly, using standard accepted definitions and the analysis shown, it can be seen that only one-half, in fact, less than that, I rounded it to one-half, as many Enforcers would be required for the presented mission profile.

Digitized by Google



Slide No. 15 is a USAF chart that was presented to shown gun effectiveness. You will note it is on a single pass kill probability, and specifies opening fire at 3,000 feet. Notice the column on the left which shows the tank killing capability of various guns. The 30-millimeter GAU 8 is given a value of one, and the symbology up on the right separates the 30-millimeter, the 20-millimeter, and the 50-caliber machine gun. Very adroitly, the designations of the A–10, the A–7, and the Enforcer were left off, but later on this plotted result was used in the computer model I showed you earlier.

Now, is there anyone on this committee who could give serious consideration to attempting to kill tanks with a 50-caliber machine gun?

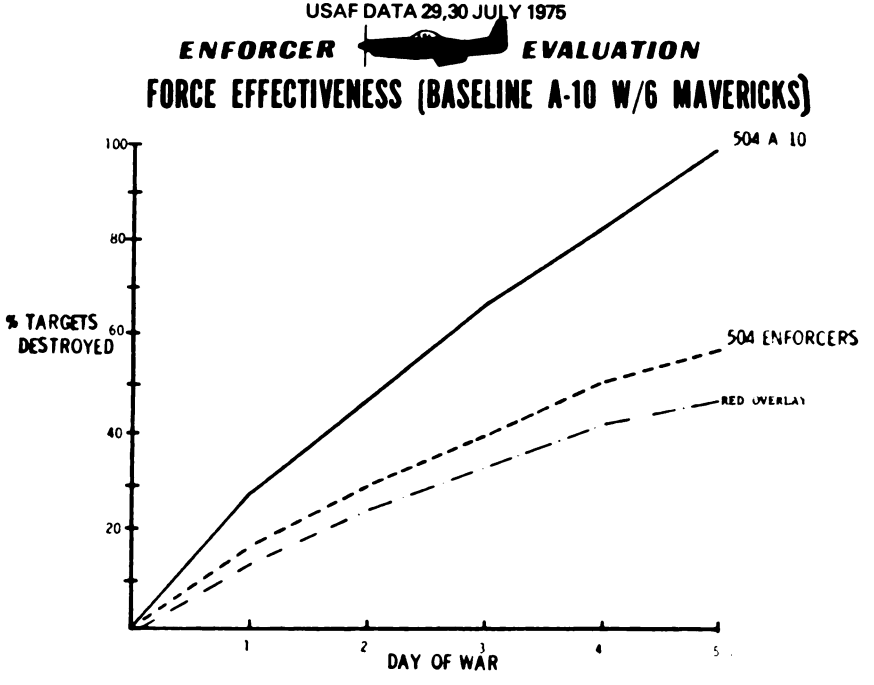
What is the purpose of this chart? It was to derive an absolutely false conclusion to go into the computer model. If one 30-millimeter has the capability shown by this chart for the A–10, then two 30-millimeter guns must be twice as good.

Gentlemen, NATO is moving to the Aden Defa 30-millimeter pod as standard—even the U.S. Army is now going into evaluation of it for NATO standardization—and the Enforcer can carry two of them. Using the U.S. Air Force logic instead of being one-twentieth as capable of killing tanks as shown in the left column, the Enforcer is now

Digitized by Google

two times as capable as the A–10, and this applies to each of the other columns as well. It is obvious the U.S. Air Force purposely here chose to mislead this committee and other subcommittees by showing a selective weapons capability chosen to reflect their desires for the end results.

Now, if I combine the earlier erroneous attrition models with this erroneous gun chart, I end up with the conclusion that "force effectiveness analysis" as shown on the next slide, No. 16, reveals the major conclusion that 504 A–10's destroyed 100 percent of the targets while 504 Enforcers destroyed only some 40 percent of the targets. Balderdash.

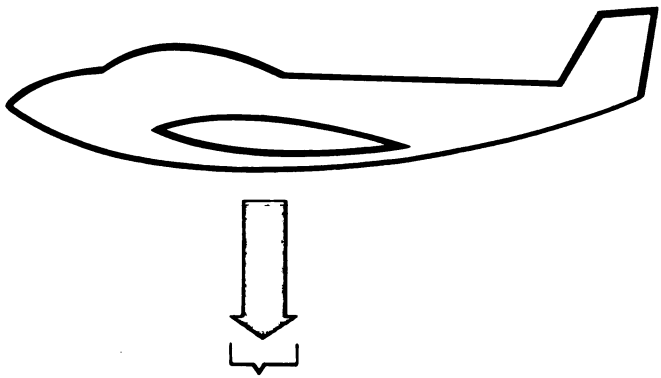


I have just shown the committee how the U.S. Air Force played with the numbers to arrive at the conclusions shown, whereas on a survivability basis it would take only 252 Enforcers to do the job of 504 A–10's, and if I give the Enforcer credit for two 30-millimeter pods and equate that to a single pass capability—remember, that is what the U.S. Air Force did on the earlier chart—then I can kill twice as many targets with one-half the number of Enforcers as compared to the A–10, or only 126 Enforcers.

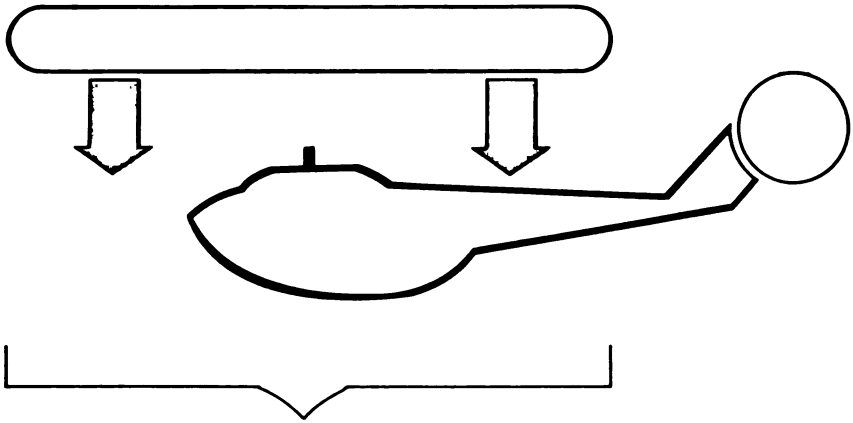
This is, of course, the exact reason we urge the test program, for such an answer is not logical. Even without the dual 30-millimeter pod capability, and reducing the ordnance to a common load of Mavericks, the curve should be the reverse of these numbers. Only 252 Enforcers would be required to equal the 504 A–10 aircraft.

The derivation thus has shown the force effectivness of the Enforcer is some two times that of the A–10, and that is after the various conservative choices made earlier.

Digitized by Google



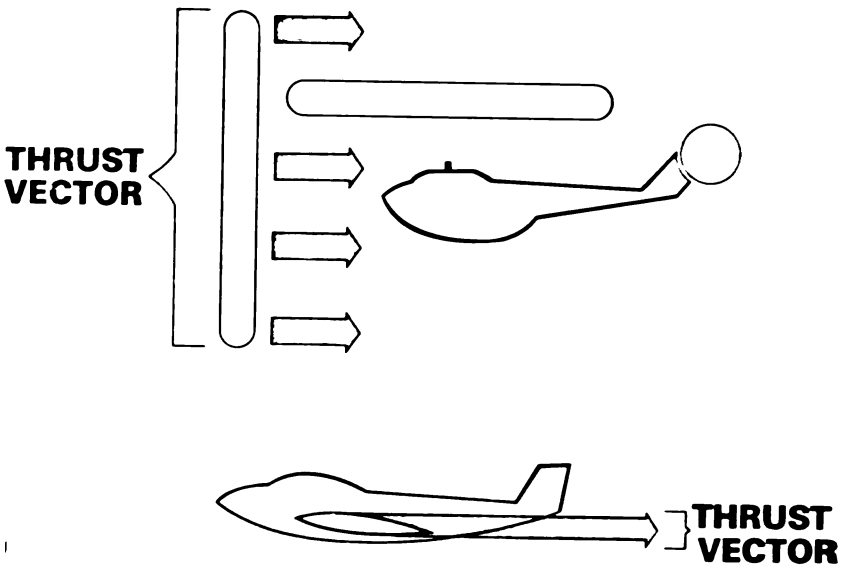
LIFT DIAMETER



LIFT DIAMETER

One more comparison is in order before we terminate this examination. Chart No. 17 shows the obvious downward thrust area of a helicopter as compared to a jet blast. To get sufficient force from the jet engines, they must reach the peak of power, which is the highest possible temperature, which is the highest possible fuel consumption. The larger helicopter blades can lift the same weight with far more efficiency. Now, the engine does not care in what direction it is being pointed; it has the same efficiency, and therefore, as the next slide shows, No. 18, if I could rotate them both forward, the basic efficiencies of the lower disc loading, or lower velocity, of the helicopter is still present.

Digitized by Google



If I reduce the helicopter rotor diameter to a propeller diameter, and expand the jet engine to a turbofan diameter, I have the two of them much closer together, but nowhere near equal. The turbine engine driving a propeller will be far more efficient at medium to low subsonic speeds, and that is where air support must be done.

Now, if I tilt that propeller up slightly, I then have an upward component, helping to lift the airplane upward and forward, and the propeller slipstream over the wing is of higher velocity than the same corresponding air over the wing of the jet airplane. Therefore, I get earlier and more wing lift per unit of forward velocity. For both aircraft moving forward then, due to the propeller slipstream, I get more velocity over the wing of the propeller airplane and therefore have additional lift.

This principle was, of course, learned years ago, and today we and our competitors use it for the design and manufacture of agriculture spray airplanes. They operate from cottonfields, wheatfields, roads, pastures, any place that is bare.

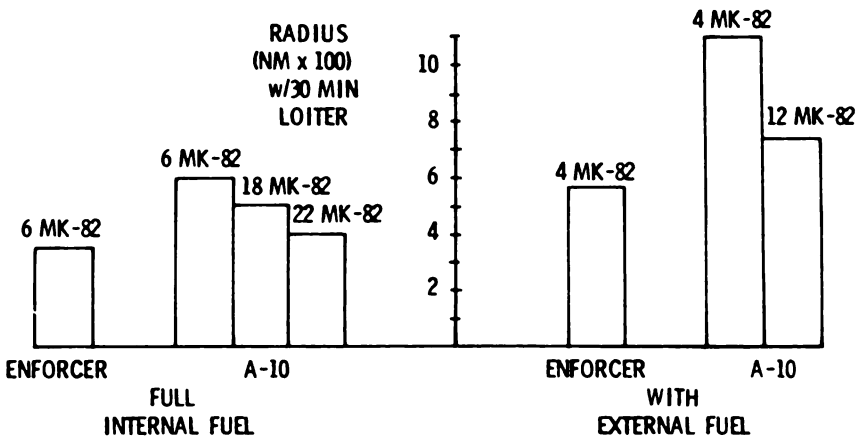
New technology is continually applied to the spray and dispersal systems, to the basic powerplants, the avionics, and other items that can help, but the landing gear geometry cannot be equated, just like a four-wheel car cannot be equated by trying three, five, or some other number.

Since on the ground a tricycle airplane is level, even nose down sometimes, the drag of the main gear in the mud or dirt with the force or thrust level above the fulcrum, this always drives the nose gear into the mud. No tricycle type airplane is ever used for rough or nonrunway landings, and even sod landing fields must have a relative dryness. This was confirmed in the earlier USAF slides on California bearing ratio.

Digitized by Google

ENFORCER EVALUATION

ENFORCER/A-10 RADIUS COMPARISON

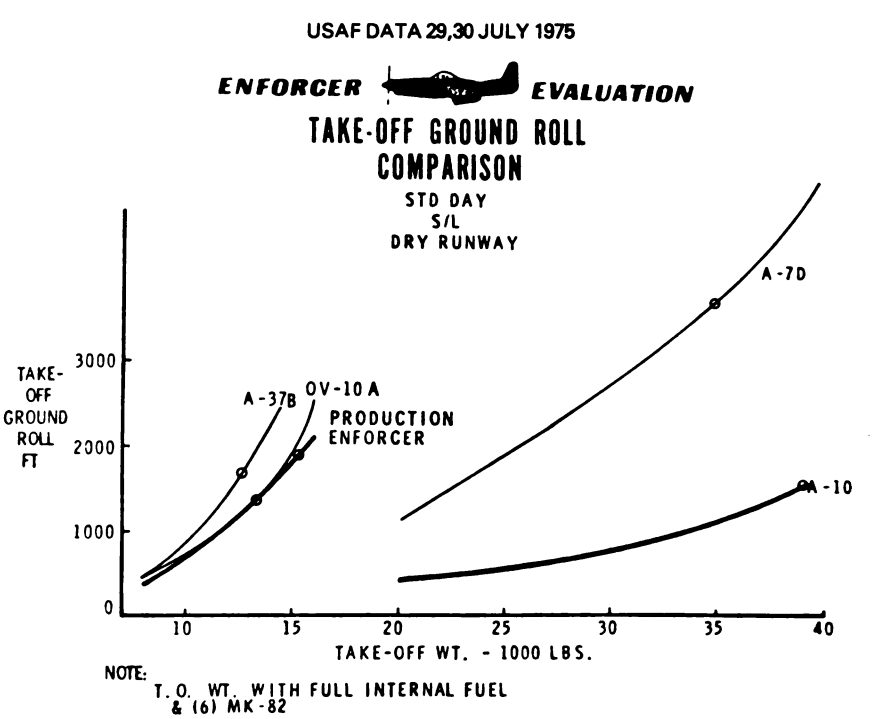


Now, with those thoughts in mind, let us look at slide No. 19, which shows the Enforcer versus the A–10 radius comparison. As in the former cases, this is a USAF chart; I did not make it up. On the left side, this chart shows the USAF concurs that the Enforcer can carry six 500-pound bombs to a radius of approximately 350 nautical miles with 30-minute loiter and return.

Correspondingly, by this chart the USAF told the Senate Armed Services Committee the A–10 could carry the same six MK 82 bombs, that is, six 500-pound bombs, out to a distance of approximately 600 miles, and have the same loiter capability.

In fact, to show how superior the A–10 was to the Enforcer, and demonstrate what a superb machine it was, the USAF told the Congress the A–10 could carry 22 MK 82 bombs, or 11,000 pounds, and for a distance greater than the Enforcer could even carry 6 such bombs, and as the chart shows, the USAF told you they could carry this load nearly 400 miles.

Digitized by Google



Now, that is 22 bombs, or 16 more than the Enforcer. It is 8,000 pounds. In fact, it is not only 16 more than the Enforcer, it is 16 more than the USAF showed you on chart No. 1, the takeoff roll chart.

That chart showed a takeoff roll of approximately the same as the Enforcer, but the USAF claimed in their prior submittal a load-carrying capability 8,000 pounds heavier, which would go completely off that first chart, which was slide No. 1, and with a takeoff weight of approximately 47,000 pounds. The column on the right shows what the USAF presented to the Congress for capability with external fuel. Neither, of course, give any indication whatever of capability from unprepared fields. As Mr. Lindsay noted earlier, NATO and member nations doctrine recognizes the Communist superiority of numbers, and the resultant loss of hard runways in the first 2 to 6 hours.

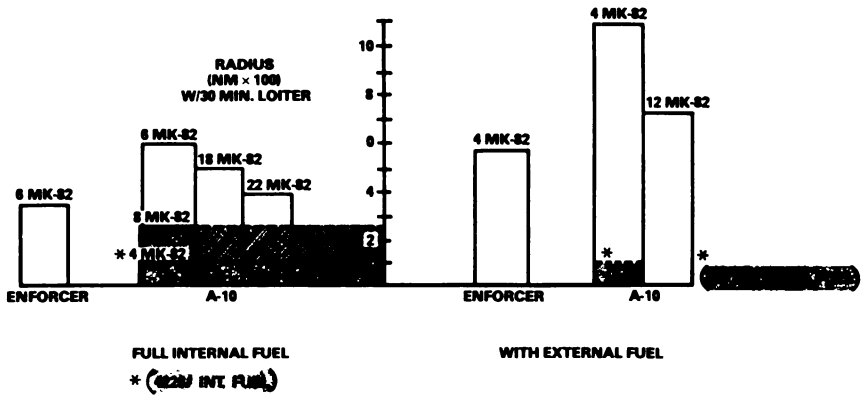
We therefore requested, through the professional staff of the subcommittee, what the actual test results of capability showed, and we requested a definition of forward field capability. We were advised no such definition now exists, and the criteria now used is that the field must have a hard surface runway. Put more succinctly, the A–10 is bound to hard runways which will last only 2 to 6 hours after zero.

Apparently, after that the Army is on its own.

More important yet, the staff furnished us with the requested A–10 results, and the next chart, slide No. 20, shows them plotted on the very same USAF chart.

Digitized by Google

ENFORCER/A-10 RADIUS COMPARISON



The reason the heading is not on is, we had to slice the chart up to get the coding down below.

We all see that on this one, which requested a half radius, that the A–10 has a capability of 400- or 500-pound bombs plus gun ordnance. It cannot carry full internal fuel and its radius as presented to us is 50 miles forward and 150 rearward.

Again, gentlemen, I emphasize this is not data generated by Piper. I must seriously question, on behalf of Army troops, the import of USAF planning to work forward 50 miles and rearward 150. A 50-mile forward movement and 150 rearward is an average of 100 miles. However, this is true only if it has a runway and allows only 20 minutes fuel reserve.

As of this moment, it appears the A–10 has no capability on other than a runway. Under this condition the A–10 has no external fuel capability as shown on the right. Both are drastically different from what has been presented to this committee, as shown on this slide.

We then asked, with full ordance load, what is the combat radius and takeoff distance.

We were advised the full fuel-full ordnance load was eight 500-pound bombs or 4,000 pounds—the Enforcer flew with over 5,000 pounds—a takeoff roll of approximately 4,000 feet—the Enforcer is approximately 2,000 feet—and a combat radius of 264 miles—the USAF evaluation credits the Enforcer with approximately 350 nautical miles at 3,000 pounds.

To remain objective, this latter data did include loiter of 1 hour compared to the 30 minutes used earlier, and credited to the Enforcer. However, the Enforcer actually flew with over 4,500 pounds external, which more than accounts for the fuel requirement necessary to stay the additional 30 minutes for equalizing the hour.

In summary, the test data today shows the A–10 is drastically inferior and grossly incapable of doing what the USAF chart showed it would. So, we now have a comparison of the Enforcer having far greater survivability, greater mission effectiveness, and now the only airplane with a forward or unprepared basing capability.

Digitized by Google

ENFORCER EVALUATION
ROM PROGRAM COST SUMMARY
(1977 $ IN MILLIONS)

	1975 cost per USAF	USAF 1977 cost adjusted for inflation	PIPER 1977 cost	A-10 1977 cost
PROTOTYPE (4 AIRCRAFT)	$ 10.8	$ 12.4	$ 10.6	—
FULL SCALE DEVELOPMENT (6 AIRCRAFT)	129.9	149.6	78.0	—
PRODUCTION (733 AIRCRAFT)	955.3	1,100.5	944.5	—
FLYAWAY UNIT	(1.06)	(1.22)	(.902)	(4.3)
TOTAL ACQUISITION	$1,096.0	$1,262.5	$1,033.1	—
ANNUAL OPERATING & SUPPORT PER SQUADRON	$ 8.5	$ 9.8	$ 6.86	—
PROGRAM COST	$ 1.50	$ 1.73	$ 1.40	6.3

Fortunately, the comparison of cost data is far more simple. The next chart, slide No. 32, shows the USAF ROM program cost comparison. However, on this one I have made two additions. The cost column on the left is the original data furnished by the USAF. The next one to the right, that is, the left—merely takes the former data, the one on the left, and applies an inflation factor to bring it up to date, and that same inflation factor is a constant used throughout all this cost data. It is applied to their data the same as Piper's. Therefore, there is no difference, and if it is in error, then it is a consistent error.

The column second from the right is Piper's estimate, and you will note the major difference is in the six-aircraft development program shown here, with the Air Force originally estimating up to $129.9 million. Applying a factor for inflation takes it to $149 million. Piper's estimate to date is $78 million.

In their testimony, the USAF stated it could be up to $129.9 million. No mention was made of the likelier probable value, or how low it could be, but that high number was certainly advertised in all their figures, because they said that is how high it could be. As you see, we strongly disagree. Our figure of $78 million is within 6 percent of the Navy's estimate for the same R. & D. program.

So, we give it very good credibility.

Digitized by Google

ENFORCER EVALUATION
PIPER-USAF UNIT COST COMPARISONS
(1977 $ IN MILLIONS)

	400 AIRCRAFT		700 AIRCRAFT	
	PIPER	USAF	PIPER	USAF
AIRFRAME	$ .655	$ .803	$ .608	$ .651
ENGINE	.217	.257	.205	.247
PROPELLER	.072	.066	.072	.063
AVIONICS	—	.042	—	.040
ARMAMENT	.018	.036	.017	.034
HUD/MAV	—	.213	—	.200
TOTAL FLYAWAY COSTS	$ .962	$1.417	$ .902	$1.235
VARIATION	32.1%		26.9%	

The next chart, slide No. 23, shows the Air Force Comparison of Piper's and USAF's estimates. This is not the exact original data. It is the original data but with the same inflation factor applied in both cases. We were pleasantly surprised to see the 700 aircraft program had a difference of only 8.4 percent on the original 1975 USAF comparison. That is not shown here. Part of that was due to our not knowing the cost of certain GFE we specified as needed. The USAF compiled a cost for the GFE and it shows as an adjustment.

These adjustments would increase the 962 and $902,000 shown here, 962 and $902,000, to values of $1,206,000 and $1,130,000 respectively, still approximately one-fourth of the A-10 data shown in the right column, from the latest SAR report furnished. So, using USAF estimates of USAF data and the USAF R. & D. program which we say are still too high, even using their data, we are approximately one-fourth the cost on a unit flyaway basis or program cost.

To give you two points of reference, then, the USAF estimate of flyway price based on 700 aircraft was $1,072,000, while the Piper estimate was $782,756. Applying a common inflation factor of 15.2 percent results in values of $1,235,000 and, as I said, $902,000, respectively. Even with the inflation value, Piper's estimate is that a unit flyaway price of under $1 million can be achieved.

The USAF data presented to the Congress on ROM program cost summary results in an Enforcer unit program cost of $1.5 million. With inflation factors as outlined above, that would increase to $1.722 million. Again, using the earlier referenced SAR report figures of $6.3 million, each A-10 equals 3.65 Enforcers. Using Piper's flyaway price, and the same percentage increase to program cost as presented by the USAF, the Piper program cost would result in 4.5 Enforcers programed for each A-10.

Digitized by Google

USAF DATA 29,30 JULY 1975

ENFORCER EVALUATION

COST COMPARISONS

($ IN MILLIONS)

	A-10 IN 31 MAR SAR	ENFORCER IN 31 MAR SAR FORMAT
DEVELOPMENT	$ 364.2(A)	$ 140.7(A)
PROCUREMENT	2064.7(A)	955.3(A)
PROVISIONS FOR ECONOMIC CHANGE	730.8	348.1
TOTAL PROGRAM	$ 3159.7	$ 1444.1
PROCUREMENT UNIT COST	$ 3.81	$ 1.72
PROGRAM UNIT COST	$ 4.25	$ 1.94
QUANTITIES:		
DEVELOPMENT	10(B)	10(B)
PROCUREMENT	733	733

NOTES:

A. 1975 DOLLARS FOR OUT YEARS

B. INCLUDES 4 PROTOTYPE A/C.

FLYAWAY UNIT COST IN FY 75 $:

A-10 - $2.23

ENF - $1.06

The final chart, slide No. 24, shows the cost comparison in program format. Again, this chart was made by the USAF and not by me. In the interest of time and expediency I direct your attention to the third line from the bottom, labeled, program unit cost. The latest SAR report now shows the A–10 at $6.3 million each. If I apply the same inflation factor, 15.2 percent, the $1.94 million shown on this slide for the Enforcer becomes $2.23 million. This is an Air Force number derived by the Air Force.

If I apply inflation to that $1.94, it becomes $2.23 million, or approximately one-third the A–10. This is the lowest ratio of any kind I have been able to derive of an Enforcer and an A–10.

Our estimate of program cost is such that we, of course, do not agree with this high number. Our estimate is $1.4 million, and equals approximately 4½ Enforcers for each A–10. Incidentally, we also feel that unit flyaway cost is a much closer appraisal value for comparative purposes, since program cost is too difficult to define.

Digitized by Google

To show the potential impact of the consideration before this subcommittee today, I want to use one final item not normally considered by most, but absolutely vital in today's events occurring in the United States. The cost data showed by the USAF is based on 733 airplanes, and the program unit cost reflects this; 733 airplanes at 72 aircraft per wing equals 10.1 wings, and if I take a 10th of a wing out for R. & D., development, and that sort of thing, that leaves 10 wings.

The data I showed you on the USAF chart earlier for all of the European scenarios used 504 aircraft, which is exactly 7 wings. We are now in a true high-intensity conflict. We fly every single airplane every mission possible. But to make my point, I will assume 4 sorties each per day for the 504 aircraft. Some may say it could 5 6, or 7. You pick your number, because it will apply to each accordingly, in direct ratio. Or, for the 504, aircraft, a total of 3,528 sorties per day.

The USAF data furnished on the former chart specified a 20-minute fuel reserve which was given to the subcommittee staff and given to us. Therefore, if the airplane has a normal takeoff internal fuel of approximately 10,100 pounds, a 20-minute fuel reserve would leave approximately 800 pounds, or a total of 9,300 pounds used, at the end of the mission.

To make the math easier for all of us, let's round it off to 9,000 pounds; 3,528 sorties at 9,000 pounds per sortie gives us 31,752,000 pounds of fuel per day, or 4,536,000 gallons. Using 10,000-gallon tank trunks or tank cars, this means a daily stream of over 450 tank cars, with all the equipment, the roadbed, the men, the engines, if you can find that many tank cars, necessary to supply just the fuel for this force.

Using exactly the same criteria, 4 sorties per day, per aircraft, 504 aircraft force level, et cetera, the Enforcer would use 2,200 pounds of fuel per mission, and I won't round that off to 2,000—penalize it all the way—or 7,761,600 pounds of fuel, or 1,108,800 gallons. This would require 110 cars per day, or just under one-fifth the total fuel requirement of an A–10 force in Europe.

Gentlemen, in a fuel critical world, that is a reduction of 23,990,000 pounds of fuel per day, over 3,427,000 gallons less fuel required for the Enforcer, utilizing a capability of 2 to 1 survivability improvements with the same mission effectiveness and less than one-fourth cost.

Such a significant item requires even stronger consideration for peacetime operations which will go on in any event, irrespective of potential war. At one and one-half sorties per day, and any number can be chosen—I chose that as an average, but for one and one-half sorties per day, the 504 aircraft during training in peacetime will use 6,048,000 pounds of fuel each working day, or 864,000 gallons. On a similar basis, the Enforcer would use 1,360,800 pounds, for 194,400 gallons. With Enforcers used in the training program, every working day the Government would buy 4,687,200 pounds, or 669,600 gallons less fuel, and for 200 working days a year that means a savings of 138,800,000 gallons of fuel per year, just in peacetime. At 50 cents per gallon that is $66,900,000 per year, nearly enough to pay for a full wing of Enforcers.

Now I think you can see rather clearly why we do not agree with the USAF apraisal of cost as regards the Enforcer.

Digitized by Google

Gentlemen, it now starts to become clear that when one sits down and takes the time to think out these tentacles of major impact, such as the critical fuel comparison, that the colloquy of presentations with these slides, charts, et cetera, that have been presented have totally emasculated the hard factual data necessary for this committee and the Congress to make informed decisions.

Mr. Chairman, I recognize this has been a somewhat lengthy presentation, including some level of technical discussions, which was required to set the record in its proper perspective. I will now briefly summarize our presentation.

One: There is a known need for close-air-support capability to support our own and NATO ground forces.

Two: Independent studies by the U.S. Navy and the U.S. Air Force both confirm the Enforcer will meet the claims as presented with but very minor and rather easily correctable variances.

Three: The U.S. Air Force, falsely or erroneously, advised the Senate Armed Services Committee of the survivability of the A–10 when making comparisons with the Enforcer, in that it completely ignored the probability of being hit, and thereby generated false comparable force level requirements.

Four: The erroneous survivability data presented resulted in attrition rates depicting a force level advantage to the A–10, when in fact the exact reverse occurred.

Five: The U.S. Air Force, falsely, or erroneously, advised the Senate Armed Services Committee of a mission profile capability of the A–10 compared to the Enforcer, again creating an erroneous conclusion as to mission effectiveness.

Six: The Enforcer represents exactly what our Nation's technology data bank should be used for: The extraction of the proper subsystem technology level to insure the overall system has maximum operational cost effectiveness for the mission intended.

Seven. My company has built more airplanes for rough field operations than all of the prime aerospace suppliers to the Department of Defense combined. Having built over 5,000 AG airplanes, I can tell you factually no airplanes in the world receive such hard use and daily abuse in unprepared fields as does an AG airplane. Not one made by my company, or my American competitors, has a nose wheel; that is, a tricycle landing gear. It just will not work. New technology be-danged.

Eight: The turboprop power subsystem is ideal propulsion for a close-support airplane, due to its fuel efficiency, high static thrust, reliability, and near nonexistent infra-red signature.

Nine: Using correct attrition and mission profile models, there is good data to conclude that in a NATO scenario of warfare, far less Enforcers would be required than A–10's, and it may be less than one-half the number.

Ten: Using the USAF's own cost estimates and SAR report, 700 Enforcers could be fielded for approximately one-fourth that required for an equal number of A–10s, a saving to the American taxpayer far in excess of $2 billion.

Eleven. Cost data supplied by our company shows an even greater disparity in program cost, and indicates between four and five En-

Digitized by Google

forcer aircraft can be fielded for every A–10. On a direct cost basis of 4 to 1, and with a survivability ratio as derived of 2 to 1, simple mathematics shows a cost effectiveness for the Enforcer of 8 to 1 over the A–10. Even if I am as much as one-third wrong, the resultant is still far too dramatic to ignore.

Twelve. The requested test program offers no technological risk, and may very well show this body a path to an improved and vastly less costly close-support capability for our ground forces, a need that is startlingly clear.

Thirteen. We have never requested a comparison of the Enforcer as a replacement for the A–10. That is a decision for the Congress. This has been initiated each time by the USAF as a basis for opposing operational tests of the Enforcer. We do believe that no possible question exists that justifies withholding immediate approval of an operational test program for at least four Enforcer aircraft, and we solicit this subcommittee's favorable consideration.

Mr. Chairman, I thank you for your patience during this long presentation.

Senator GOLDWATER. Thank you very much. It was a very interesting presentation, very well done, and I congratulate you on it. Now, Senator Thurmond, I think it is proper that you do the interrogating.

Senator THURMOND. Thank you very much.

Mr. Chairman, I would like to express my appreciation to Chairman Cannon, who is unavoidably absent due to the illness of his mother, for scheduling these hearings today on the Enforcer aircraft. I would like also to express my appreciation to our able colleague, Senator Goldwater, for presiding over these hearings very capably.

Earlier in our series of hearings we have had testimony from the Air Force relative to the fact that in NATO our forces would be greatly outnumbered in tactical aircraft, and tanks by the Warsaw Pact. I will not go into the numbers, as this is an open session. While the Air Force has been opposed to tests for the Enforcer, General Stewart, in testimony before our Research and Development Subcommittee, verified the following Enforcer claims in comparison to other close-support aircraft.

One, it is less vulnerable to heat-seeking missiles. Two, it can carry Maverick missiles, ECM pods, and the HUD. Three, size makes it less likely to take battlefield hits. Four, it is truly forward deployable on unprepared fields. Five, it operates in the same speed range as the A–10. Added to this, recent testimony on the A–10's forward field tests were based on a bomb load of 2,000 pounds, a load comparable to that of the Enforcer.

The key item, to my way of thinking, is that the Enforcer can be procured at about $1 million per copy, one-sixth, or, it was brought out here, some said one-fifth and some one-fourth, the cost that the Air Force is now buying.

Thus, I hope these hearings will show that the survivability, the vulnerability, and the lethality of this plane compares so favorably with that of high-cost aircraft that tests are fully justified.

Now, several articles have been written, Mr. Chairman, and I would ask unanimous consent to put them in the record, especially about

Digitized by Google

three here. One is "Air Roles for Recoilless Rifles." This is from the Armed Forces Journal International. Another is, "An Attack Aircraft Is Cheap, Good, and Gets Cold-Shouldered:" "Prototypes Still in Storage Ignored by Pentagon;" "Threat to Pet Products." That came from the Wall Street Journal. Another one, "Pentagon Ignores Attack Plane That Is Cheap and Gets High Marks."

Another article is from the Washington Star, "Taxpayers Deserve Tests of Less Expensive Plane." Another one is, Aviation Week. "Flight Test Program Sought for Enforcer," and also a letter that was written by Senator Proxmire, Senator McIntyre, Senator Tower, and Senator Henry Jackson and myself, to the Secretary of Defense, requesting tests of this airplane.

Mr. Chairman, I ask unanimous consent that those be put in the record.

Senator GOLDWATER. They will be made a part of the record.

[The information follows:]

[From Armed Forces Journal International, July 1974]

AIR ROLE FOR RECOILLESS RIFLE?

A benchmark in weapon capabilities was reached quietly at Naval Weapons Center, China Lake, CA, on 13 June.

On that day Marine Lt. Col. John Pipa, flying an old Cavalier Mustang F–51D, successfully fired a 106 mm recoilless rifle mounted on a wing tip. It was the first time a recoilless rifle was fired from an aircraft in flight. Until now weapon experts said it was an impossible task that undoubtedly would wreck the aircraft.

Supporters of airborne recoilless rifles in a close support role claim they're extremely lethal against tanks and hard ground targets and are much cheaper to buy, operate, and maintain than more sophisticated air-to-ground close support weapons. For example, a round of 106 mm ammunition costs $30 (buying in quantity) compared to a Maverick missile's cost of about $13,000.

The firing at China Lake on 13 June took place with the F–51 at an air speed of 250 knots with a dive angle of 22½ degrees and slant range to impact area of 4,638 meters.

Navy sponsored the firing with a lot of help from Army and Marine Corps. In the past year Navy has spent about $95,000 on the project which includes costs of static tests, analysis, mounting, and the demonstration flight. Encouraging the demonstration was the inventor of the recoilless rifle, Dr. Walt Musser and David Lindsay, a Florida publisher. Lindsay designed an installation for mounting the rifle on the F–51D. Both Musser and Lindsay served as unpaid consultants to the Navy for the test. (They didn't even get expenses.) Lindsay admits his interest is not exactly altruistic. He's been interested in selling the Pentagon a cheap close support aircraft armed with a recoilless rifle for the past three years with little success.

Watervliet Arsenal, NY, furnished the rifle and ammunition "in return for blast and structural response data." Earlier, Watervliet had declined to participate claiming that the Army Weapons Command was more interested in investigating the feasibility of mounting a recoilless rifle on a helicopter. So far this hasn't been done.

Until now it was thought that the rear muzzle blast of a recoilless rifle would blow an aircraft out of the sky. The test firing disproved that. Col. Pipa said there was no impingment by the blast, and no deflection of control. He said the only sensation was an extremely loud blast. The flight and firing was photographed from helicopters in firing area, by telephoto from the ground and from an A–4 Skyhawk aerial chase plane. Firing was judged successful by all monitors.

The 106 mm recoilless is a single shot weapon. It and its ammunition are cheap enough to permit multiple mountings which would allow near saturation firing of a tank target at low cost. Since normal tank doctrine includes using great numbers of decoys this low cost would justify aggressive air-to-ground hunter-killer tactics with a good chance of maximizing actual tank kills.

Digitized by Google

[From the Wall Street Journal, May 30, 1974]

An Attack Aircraft That's Cheap, Good, Gets Cold Shoulder

Prototype Sits in Storage, Ignored by the Pentagon; Threat to Pet Projects?

(By Richard J. Levine)

WASHINGTON.—It can take a lot to shake the Pentagon's weapons-building bureaucracy out of its accustomed ways—more, apparently, than even the formidable ingenuity and persistence of aircraft designer David B. Lindsay, Jr.

Mr. Lindsay, who is also a wealthy Florida newspaper publisher, has been trying for three years to interest the Defense Department in his design for an attack aircraft to provide close support to ground troops. He has built a rugged little warplane, called the Enforcer, that packs a potent punch, carries a bargain-basement price tag, gets high marks for performance—and leaves the Pentagon cold.

Designer Lindsay has run into one bureaucratic roadblock after another. He has failed to persuade the Pentagon to give the Enforcer a full-scale flight test, must less consider buying it.

"I'm totally frustrated," he says. "We aren't selling anything. We're just trying to get the plane tested. The Defense Department has given up knocking the airplane and now says, 'There's no requirement for it.'"

The apparent reason for official coolness is simply that the military brass fears that the Enforcer would show up, or even threaten, such pet projects as the Air Force's new A10 attack jet and the Marine Corps' vertical-liftoff Harrier; those planes, which are designed for the same close-support role as the Enforcer, are more costly and complex.

"The services are closing every door they can," says a staff member of the Senate Armed Services Committee. "The Enforcer is too practical and too cheap to appeal to them."

LONELY STORAGE

And so the prototype plane, developed entirely with funds put up by Mr. Lindsay and Piper Aircraft Corp., sits in lonely storage in Vero Beach, Fla., far from the wild blue yonder.

(Mr. Lindsay is an unpaid consultant both to Piper, which bought the prototype, patents and manufacturing rights from him in late 1970, and to Lockheed Air craft Corp., which last year made an agreement with Piper that could give it manufacturing rights.)

Ironically, Pentagon rebuffs of the Enforcer have coincided with calls from Defense Secretary James Schlesinger for simpler, cheaper warplanes. And officials concede that Mr. Lindsay's baby is such a craft—and more besides. After seeing Air Force and Marine Corps studies of the Enforcer, Deputy Defense Secretary William Clements, the Pentagon procurement chief, wrote: "There is little question the Enforcer can meet the general performance claims."

But he added that "neither service sees a role for Enforcer in the combat scenarios on which their future plans for aircraft inventories are based." Charles Meyers, assistant director of Defense Department research for air warfare, puts it more plainly. "It's a nifty little airplane," he says. "But unfortunately the office of Secretary of Defense doesn't have the power to stimulate the services to have a need for the thing."

UNCOMPLICATED AND INEXPENSIVE

What intrigues Mr. Meyers and other aircraft experts is that the Enforcer is uncomplicated and inexpensive. (At an estimated $770,000 each, it would cost a lot less than the Harrier's $4.3 million and the A10's $3.4 million.) The Enforcer can operate from short, rough runways, stay aloft for long periods and deliver heavy firepower—ideal qualities for close-support aircraft.

The Enforcer has a speed range of 86 to 440 miles an hour and is heavily armored to protect the pilot from ground fire. It mounts six internal .50-caliber machine guns that can each spit out 1,100 rounds a minute, and it can carry 10 rockets, missiles or bombs.

"As far as shooting up people with guns or stopping tanks with missiles," Mr. Lindsay says, "we think the Enforcer will do it as well as or better than the A10 and at one-fourth the price."

Digitized by Google

In an age of sleek jets, it's true, the Enforcer hardly appears sexy. It most resembles the famed World War II P51 Mustang and has, of all things, a propeller. But Mr. Lindsay stresses that the propeller is driven by a jet engine, which should make for extreme reliability and easy maintenance.

Moreover, he contends that a jet-prop plane like the Enforcer has a significant advantage over a pure jet in flying slow-and-low close-support missions. Because most of the heat from the engine is used to turn the propeller, rather than being pushed out the rear of the engine, the Enforcer should be a lot less vulnerable to heat-seeking antiaircraft missiles, which proved so deadly in last October's Mideast war.

While the Enforcer generally draws high marks, it isn't faultless. A pilot who has flown the plane describes it as a "bit of a tail dragger." And Gen. Robert Cushman, commandant of the Marine Corps, recently wrote that the Enforcer "would provide a lesser combat capability" than light attack jets currently in the Marines' inventory, although he didn't make any detailed comparisons.

The Enforcer grew out of Mr. Lindsay's interest in restoring P51 Mustangs during the 1960s for sale to Latin American countries through the U.S. military-assistance program. Using ideas picked up from American pilots who had flown in Vietnam, Mr. Lindsay started designing the plane. In the spring of 1971, when the U.S. Air Force sought ideas for a counterinsurgency plane for the South Vietnamese, he and Piper Aircraft stepped forward with the Enforcer.

In August 1971, Air Force pilots briefly flew the Enforcer at Eglin Air Force Base, Fla. One of them, now retired Major James Tilburg, says today: "It did as much as or more than was designed into the test plan. Technically, it didn't have all that fancy stuff. It was just a good platform that could take the punishment and deliver the ordnance."

After these 1971 flights, the designer, Mr. Lindsay says, "we went back to Vero Beach and waited for an order." When nothing happened, he returned to the drawing board and kept on improving the aircraft. In early 1973, disgusted at the government's inaction, he started making the rounds of Pentagon and Capitol Hill offices in an effort to win a full-scale flight test of his plane. But all he got was a paper study—and, last month, word that there isn't any need for the Enforcer. Today he will tell the full story to the House Appropriations subcommittee on defense.

About $3 million has gone into the development of the Enforcer, roughly one-third of it from Mr. Lindsay's pocket. A full flight test would cost about $6 million—money that Chairman John Stennis of the Senate Armed Services Committee has indicated would be available if requested by the Defense Department.

To Mr. Lindsay and such key legislators as Republican Sens. Barry Goldwater of Arizona and Strom Thurmond of South Carolina, it makes good sense to test the Enforcer further. In Mr. Lindsay's view, the plane would provide "damn cheap insurance" against the failure of the A10, not yet in production, and he contends that it would find a large market overseas, especially in Asia.

Perhaps Democratic Rep. Robert Sikes of Florida summed up the situation best a year ago, when he told then-Navy Secretary John Warner during a hearing:

"I have noted other instances, Mr. Secretary, where weapons systems and equipment have been offered to the services but because they were not developed by the testing service, they were given the cold shoulder. I do not think that is the proper approach.

"I think the services should be willing to test equipment that has promise. The old P51 was a great aircraft in its day. That was a long time ago. Maybe it no longer has any value. But this is a modernized version, and if it does have value, it could save the government a lot of money. We would like to have more than paper studies."

[From the Washington Star, Nov. 18, 1975]

Taxpayers Deserve Test of Less Expensive Plane

(By Crosby S. Noyes)

In these days of soaring defense costs—and soaring public resistance to these costs—some things happen that defy any rational explanation. One of them was the elimination by the Senate last week of $5.6 million to flight-test a close-support attack plane known as the Enforcer.

Digitized by Google

To back off for a moment. Anyone who has ever flown a plane in support of ground troops knows that the problem is not one of speed and sophisticated equipment.

Against relatively immobile targets on the ground, what is needed is a reliable platform which can stay in a given area for an adequate length of time and deliver an effective volume of firepower. In Vietnam, the job of close support was performed largely by helicopters, which, while efficient, were also extremely vulnerable to ground fire.

One of those aware of the problem is David B. Lindsay Jr., an ex-fighter pilot, aircraft designer and Florida newspaper publisher. Back in 1971, when the Air Force was looking around for a plane for counterinsurgency work in South Vietnam, Lindsay went to work in developing the Enforcer.

The result, according to Charles E. Myers Jr., assistant director of Defense Department research for air warfare, is a "nifty little airplane." Starting from the basic design of the World War II P51 Mustang, the Enforcer has been given a turbo-propeller engine that drives it at speeds from 86 to 440 miles per hour.

It is more heavily armored than any comparable aircraft. It packs six .50-caliber machine guns, in addition to ten 1,000-pound bombs or missiles. It can cruise up to 3,000 miles without refueling. Because of its small profile and lack of jet exhausts, it should be far less vulnerable to ground fire and heat-seeking missiles than standard jet fighters.

Best of all is the price tag attached to the Enforcer. It has been designed and developed by Lindsay and the Piper Aircraft Corp. at no cost whatever to the taxpayer. The projected price per copy from Piper is under $1 million—about one-fourth the price of an Air Force A10 prototype, designed for the same mission.

Both the Air Force and the Marine Corps made preliminary studies of the plane several years ago. After seeing the results, Deputy Defense Secretary William Clements, procurement chief for the Pentagon, declared: "There is little question that the Enforcer can meet the general performance claims."

Nevertheless, the Air Force and Marine Corps want nothing to do with the Enforcer. Perhaps because they see it as a potential threat to their own, far more costly projects (the Air Force has spent some $360 million on the development of the A10 so far), the services have firmly resisted a full-scale flight test for the smaller plane for more than three years, claiming that there is no requirement for it.

For a time, it seemed that the Congress might decide otherwise. Last month, a Senate defense subcommittee voted unanimously to include $5.6 million in a Pentagon appropriations bill to pay for the building and testing of four prototype models of the fighter.

But apparently there is no reckoning with the resistance of the service bureaucracy or of the old-school ties on Capitol Hill. In what amounted to a jurisdictional dispute over the authorization, Sens. Barry Goldwater, R-Ariz., and Howard W. Cannon, D-Nev., both Air Force generals, combined forces to get the sum knocked out of the bill as a "waste of money."

As a result, the Enforcer, which just might have saved the American taxpayer several billions, is back on the old drawing board.

[From Aviation Week and Space Technology, Aug. 12, 1974]

Flight Test Program Sought for Enforcer

(By Clarence A. Robinson, Jr.)

Washington.—Flight test program and new military evaluation of the Cavalier/Piper Enforcer derivation of the World War 2 North American Mustang fighter is being sought by the developer of the aircraft, who claims it to be an effective close-support aircraft available at a reduced cost. The Enforcer previously was studied by the Defense Dept.

The Defense Dept. completed its study of the Enforcer in February, concluding the aircraft's performance characteristics were as claimed by its developer, David B. Lindsay. The Pentagon estimated the aircraft unit cost at $1.13 million, but Lindsay said it would cost $760,000 per copy based on production of 250 aircraft.

98-379 O - 77 - 41

Digitized by Google

The Pentagon's study included the percentage of the aircraft susceptible to a kill by enemy fire from six angles and was based on Soviet-made weapons fired directly at it. The weapons included:

14.5-mm. anti-aircraft gun system.

23-mm. ZSU-23-SP with four guns mounted on an armored vehicle and fired together.

57-mm. towed radar-controlled S-60, and the ZSU self-propelled version with two guns in the turret. Fire power is 240 rounds/min.

SA-7 heat seeking Grail Missile.

Defense officials emphasize the study assessed individual areas of the Enforcer to determine how much of the aircraft's area is vulnerable to a single-round kill. On this basis, the aircraft with the smallest overall area is the least vulnerable. The study did not investigate survivability—the capability of the aircraft to take a number of hits and return to base.

Two key selling points Lindsay uses on the Enforcer are its small profile and low in-flight noise level, permitting high-speed, low-level approaches with little warning to enemy forces.

Flying low altitude for weapons delivery would help the aircraft avoid radar detection, he claims.

The Enforcer as proposed to the Pentagon would be powered by an Avco Corp. Lycoming Div. T55-L-9 gas turbine engine now in production for Iran's procurement of Boeing Vertol CH-47 Chinook helicopters. The engine develops 2,445 eshp.

Lockheed-Georgia had a production option on the Enforcer that expired Aug. 2, but Lindsay, who has been serving as an unpaid consultant, said he has company assurances the option will be extended.

Because of government loan guarantees to Lockheed, the company has been precluded from acquiring the Enforcer from Piper Aircraft Corp., which bought the rights from Lindsay. Lockheed instead signed an option to produce the aircraft if orders materialized from the Pentagon or from several foreign governments that have expressed an interest in the aircraft for the attack/reconnaissance role.

Lindsay became interested in the Mustang when he purchased his first F-51D. He formed his own company, Cavalier Aircraft, and began rebuilding and improving the Mustang for the civilian aviation market. Lindsay said that at Air Force's request he built a number of advanced F-51s known as Cavalier Mustangs for the military assistance program. He mentioned Indonesia as an example, and said that nation is still flying the Cavalier Mustangs provided by the Air Force.

Lindsay said other Asian nations have expressed an interest in procuring the Enforcer with its new turboprop engine and expanded ordnance capability. In addition to Indonesia, the nations of Malaysia and the Philippines and several South American countries are seeking information on the aircraft. Lindsay said the Philippines would like to produce the aircraft or components in that country.

Pentagon officials charge the Enforcer is a step backward in aircraft development because the military services want a pure jet attack aircraft for the close-support mission.

Both the Air Force, which is now testing the Fairchild Industries A-10 aircraft for close air support, and the Marine Corps, which uses the forward-located Hawker Siddeley AV-8A Harrier vertical/short takeoff and landing aircraft, oppose test flying the Enforcer.

The technical analysis of the Enforcer by the Pentagon was the same as for any aircraft proposed by a contractor, a Defense official said. He added that in this case it meets the contractor's claims, but there is no service willing to sponsor the aircraft for testing and possible development. "The question is whether or not the aircraft has any military utility and can survive against armor. It looks attractive to the Congress because of the costs as compared to other attack aircraft," the official added.

The services believe the aircraft is of no use to them and does not have the lethality needed for the attack mission, a Pentagon official said, a reference to claims by the Air Force that the Enforcer cannot carry enough ordnance on its stations and provide sufficient loiter time to be as effective as the A-10.

Lindsay said the Enforcer has been cleared by the Air Force's Armament Development and Test Center, Eglin AFB, Fla., to carry up to six Hughes AGM-65A Maverick missiles used by USAF to destroy tanks and other armored vehicles. Lindsay has a wiring diagram for adapting the aircraft for Maverick use and plans for cockpit avionics for the missile system.

Digitized by Google

The aircraft has 10 ordnance stations under the wings and a maximum gross takeoff weight of 15,500 pounds. The Enforcer can carry 5,840 pounds of ordnance under its wing, plus six .50-cal. internal guns and 2,000 rounds of ammunition internally, Lindsay said.

The Enforcer, Lindsay said, has been qualified in both daylight and night operations during USAF's Pave Coin tests for a variety of weapons that would be used in the close-support role. These include:

Two, 1,000-lb. canisters of thinned napalm.
Two flare pods, each containing 16 flares.
Mk. 82 general purpose and Snakeye bombs.
LAU–3A 19-round rocket launcher pods.
800-lb. category cluster bomb units located on the six inboard stations.

In addition to having the aircraft qualified for a variety of USAF ordnance, Lindsay holds a patent for placing a recoilless rifle on the aircraft. He filed about three years ago on his idea for firing a 106-mm. recoilless rifle from the aircraft and a wingtip plate used to mount the weapon and avoid its back blast.

The Marine Corps has been test-flying an Army Mustang used at Edwards AFB, Calif., as a chase plane for the canceled Lockheed Cheyenne helicopter program and has successfully fired the 106-mm. recoilless rifle from the aircraft. The aircraft the Marines are testing has a piston engine and was modified and repaired by Lindsay's company. Marine officials stress it is not an Enforcer and that the 106-mm. test firing has nothing to do with Lindsay's aircraft.

The project at China Lake's Naval Weapons Center is to develop a new repeating recoilless rifle that can be fired from the center line station of an aircraft, not to perfect use of the 106-mm. recoilless rifle. The test firing with the rifle is only to determine accuracy with a recoilless flat-trajectory weapon, Marine officials said.

Lindsay said he can see why the Marine Corps and Navy would want to disassociate their services from the Enforcer because it has become politically sensitive.

The wings on the aircraft the Marines are using to test fire the recoilless rifle are not as rigid as those proposed for the Enforcer, according to Lindsay. He put two spars and extra stringers into the wing when overhauling the Mustang for Marine use. The modifications were made to accommodate 120-gal. wingtip tanks and provide the capability for mounting the recoilless rifle.

The main spar and secondary rear spar go through the tip tanks, and they are bolted on the edge of the wing outboard. This system enables an attachment plate to be bolted onto the wing and recoilless rifles or missiles can be mounted.

"My patent," Lindsay said, "encompasses a rigid wing which won't flex in turbulence and in extending it you can point the gun [recoilless rifle] at the tip of the spars or mount a wingtip tank spar through the tank and mount the gun outboard."

Lindsay claims to have obtained the Army F–51 Mustang aircraft the Marines are flying with the recoilless rifle and the 106-mm. rifles from the Army, and because he holds the patent, he has been to China Lake to confer with project officials at his own expense, he said.

The Marine Corps view on flight-test of the Enforcer was expressed by the Marine Commandant, Gen. Robert E. Cushman, who told Congress during fiscal 1975 budget hearings that an earlier offer to test-fly the aircraft was contingent on the Enforcer being in flyable condition and that the flight tests would be at no cost to the government.

DEMONSTRATION PROGRAM COST

The minimum flight demonstration program recommended to the Navy by Lockheed would cost $4.47 million, Gen. Cushman said, and that would provide only 80 percent of the aircraft's flight envelope. The figure now estimated for a full flight test is about $6 million, according to Lockheed officials. The Pentagon believes it to be closer to $8 million.

The Enforcer prototype aircraft used in the Pave Coin tests is hangared by Lockheed and would need to be refurbished after being stored for two years.

"While the existing Enforcer was reported to be in flying condition," Gen. Cushman said, "Lockheed-Georgia has stated that the existing Enforcer prototype cannot safely demonstrate the full mission performance capability of the aircraft as a Marine Corps weapons system due to inadequate longitudinal stability and control characteristics. The aircraft is not safe and would require redesign."

Digitized by Google

Gen. Cushman said the Marine Corps does not have a requirement for the aircraft in the close-air-support system. "In fact, we have gone the V/STOL route, and I believe we should continue that way," he said. The commandant said he estimated a full-fledged, full-flight envelope, reproduction program would cost $30 million.

"We feel it is too slow, too vulnerable and it would have to be made compatible with aircraft carriers and tactical airfields ashore, and it really does not warrant the expense," Gen. Cushman said.

SPEED ADVANTAGE

Lindsay pointed out the Pentagon agrees with his claim the top speed of the Enforcer is over 400 kt., faster than the maximum speed of USAF's A–10. He also claimed the Mustang of World War 2 was carrier qualified during the Okinawa campaign, and the Enforcer would have over twice the engine horsepower and a new beefed up landing gear. As for operating from small unimproved airfields ashore, Lindsay said the Enforcer with a 14,000-lb. gross weight on a standard day at sea level can take off in 1,100 ft. With a 50-ft. obstacle at the end of the runway it can take off and clear it in 1,680 ft.

One reason Lindsay has proposed using the recoilless rifle is its armor piercing capability. Another is that a 106-mm. round costs about $75 to kill a tank as opposed to missiles that range in costs from $22,000 to $100,000 per unit. Admittedly, the recoilless rifle is a single shot weapon under present conditions, Lindsay said, but so is a missile. Lindsay proposes landing the Enforcer near front line units to pick up extra rounds for the recoilless rifle.

STANDARD WEAPONS SYSTEM

The 106-mm. recoilless rifle is a standard Army and Marine Corps anti-tank weapons system.

Lindsay believes that he has been treated shabbily by the Pentagon in not getting approval for flight-testing the Enforcer. He claims he was assured by Deputy Defense Secretary William P. Clements, Jr., that to completely evaluate the aircraft it would have to be flight-tested. "Clements told me 'computers can only go so far,' indicating to me that the aircraft would be given a flight test," Lindsay said.

Clements in an April letter said his staff and the services had undertaken a study to determine what the Enforcer's utility might be. "Its findings show that there is little question that he Enforcer aircraft can meet the general performance claims made by its offerer," Clements said.

He added that cost estimates of the aircraft are within 25% of those Lockheed postulated.

Clements added that neither the Air Force nor Marine Corps has a role for the Enforcer in combat. "These reports clearly state that neither service questions the performance claimed for the aircraft . . .," Clements said.

Lindsay has been proposing the Enforcer for use as a helicopter escort aircraft for Army inventory, but the service, which has backed the Air Force's procurement of the A–10, has yet to express any official interest in the aircraft. The Army would like to avoid any roles-and-missions squabble with the Air Force over the Enforcer even though it could get the Army back into the fixed-wing, close-support business, a Defense official said.

The official added the Army Chief of Staff, Gen. Creighton Abrams, has taken the position that the Army's close-support will be provided by the Air Force. The Army does not even refer to its helicopter gunships in close air support terms to avoid rankling USAF.

One Defense official said that, if for no other reason, the Pentagon should procure and test fly four of the Enforcer aircraft to determine fuel savings from a turboprop aircraft operating in close-support at low altitudes, an area Defense Dept. is investigating because of the fuel crisis.

The armor that Lindsay proposes could also be a beneficial fallout from the Enforcer flight tests, one official said, assuming the armor is evaluated against Soviet weapons in tests similar to those conducted with the A–10's titanium armor system, firing multiple shots into it at point blank range.

Ceramic glass fiber composite molded armor plate developed by Bristol Composite Materials Engineering, Ltd., a subsidiary of Rolls-Royce, would be used to protect the pilot, engine and other critical areas of the Enforcer from heavy automatic weapons fire.

Digitized by Google

Lindsay claims that the armor can withstand hits from Soviet-built 57-mm. shells without a spalding effect, and also that the armor used in plates can be repaired in the field by unskilled personnel in a short time.

CERAMIC ARMOR PRAISED

The ceramic armor, in the estimation of some Defense officials, is one of the best features of the Enforcer, and it could be used with other U.S. aircraft.

The armor as presently envisioned for the standard Enforcer use would weigh about 1,500 lb.

The armor has been extensively tested against a variety of projectiles at the company's range as well as the British navy, army and air force ranges against rounds from small caliber to 38-mm. armor-piercing, 2.5-in. and 57 mm. high-explosive anti-tank ammounition.

The Bristol armor is about half the weight of conventional steel armor and much lighter than aluminum or titanium alloy armors with the same level of protection, according to Bristol officials. It has multi-hit capability and can withstand closely spaced hits without degrading its ballistic performance, they said.

Little degradation in strength and stiffness is experienced after ballistic attack, they added, and unlike metals, the ceramic armor experiences no plastic deformation and will not distort under excessive loads.

The Enforcer would have more armor per pound of airframe weight than any other U.S. aircraft, Lindsay said, adding that an air survivability study completed earlier this year by the Joint Test Coordinating Group rates the Enforcer one of the two least vulnerable aircraft in the world. The other is the A-10.

The Air Force and Fairchild, despite the Defense Dept.'s position that Lindsay's claims are accurate, have responded to many of Lindsay's claims for the Enforcer's capabilities, stating they are not accurate.

Lindsay has long talked against the A-10 and believes his aircraft could better it in a flyoff. The last thing USAF officials want now—after winning a flyoff against the Northrop A-9 and LTV Aerospace A-7—is another flyoff.

Congress would like to see the Enforcer at least flight-tested. "We do not believe it could ever replace the A-10 for close-support, but it might be able to offer an attractive mix in the low end of the force structure similar to the high-low [cost] mix in fighter aircraft," one senior senator said.

Right now the Enforcer is an aircraft whose performance characteristics the Pentagon agrees to but a weapon system no service really wants.

U.S. SENATE,
COMMITTEE ON APPROPRIATIONS,
Washington, D.C., July 19, 1974.

Hon. JAMES R. SCHLESINGER,
Secretary of Defense,
The Pentagon, Washington, D.C.

DEAR MR. SECRETARY: You have recently asked for the cooperation of Congress in holding down excess defense costs. As Members of the Senate, intensely interested not only in economy but also military effectiveness, we strongly recommend that you personally initiate action to test fly the Enforcer close air support aircraft.

It is our belief that the Enforcer promises such an attractive combination of economy and effectiveness that it should not be cast aside by Service biases.

We are well aware of the current viewpoint in the Air Force that they see no role for the Enforcer considering projected aircraft inventories. With limited force levels and current commitments to favored programs, that reaction is not unexpected.

It could be dangerously parochial, however, if it perpetuates an attitude of inflexibility to promising developments.

The Enforcer has impressive credentials. Secretary Clements and Dr. Currie agree that the Enforcer meets its claimed performance levels and that cost estimates are near the mark. Given that and the evaluation conducted by the Naval Air Systems Command, how can we afford not to take the final step and flight test this aircraft?

If it can be produced for under $1 million per unit, if it can operate effectively in a tank dominated battlefield, if it can fly from unimproved fields with substantial range and ordnance, then the Defense Department would be seriously remiss if this weapon system were not given a fair and impartial flight test.

Digitized by Google

You have authority to transfer certain Department of Defense Appropriations under Section 735 of the FY 1974 Defense Appropriations Bill, subject to prior approval and the reprogramming process. We urge you to consider using this authority or other means to validate contractor claims and pinpoint potential applications.

Mr. Secretary, your careful consideration of this matter and a report back on your decision will be appreciated. Both leaders of the Armed Services Committee, Senator Stennis and Congressman Hebert, have stated they would support a funding request.

Sincerely,

STROM THURMOND, U.S.S.
WILLIAM PROXMIRE, U.S.S.
THOMAS MCINTYRE, U.S.S.
JOHN TOWER, U.S.S.
HENRY M. JACKSON, U.S.S.

Senator THURMOND. I might say other commitments have kept Senator Jackson and Senator Hart from being here this morning. Senator Nunn and Senator Morgan and Senator Tower have been in defense budget hearings, and could not be here. They may come in later.

I wish to state that in my judgment, I have never heard a more convincing or more effective presentation in the 22 years I have been in the Congress of any defense weapon, Mr. Helms, than you made this morning. I want to compliment you on your excellent presentation.

COST OF ENFORCER TEST

I would like to ask you this. What would be the money needed in fiscal year 1978 to begin the Enforcer prototype program?

Mr. HELMS. $3.9 million for fiscal year 1978, the first year, I think, would do it, Senator.

Senator THURMOND. The total cost would be, as I understand, about $10.6 million?

Mr. HELMS. Yes, sir, $10.6 million.

Senator THURMOND. Now, how many years would it take to build four Enforcers and test them?

Mr. HELMS. Two years, sir. We think it can be done in 24 months.

TECHNICAL RISK

Senator THURMOND. What technical risk would be involved in this program?

Mr. HELMS. There would be no technical risk in the technical program as we envision it now.

Senator THURMOND. I have a few questions that I would like to propound to the Air Force, whoever wishes to answer them, General Slay.

General Slay, in your statement, I believe, on page 2, you made this statement: "Our analysis shows that compared with the A-10, the Enforcer was deficient in two very important attributes of a close-air-support aircraft, lethality and survivability. Our studies also show that when the Enforcer was compared with the A-10 for employment in a representative European scenario, the A-10 was more combat capable and cost effective."

Now, in view of that statement, I have a few questions here, first on lethality, I would like to propound. For a given number of targets to be attacked, the airplane with high survivability will have a low attrition rate. Is that not correct?

Digitized by Google

LETHALITY OF CLOSE AIR SUPPORT AIRCRAFT

General SLAY. That is correct, sir.

Senator THURMOND. Therefore, again, for a given number of targets to be attacked, it will require a smaller number of aircraft with the lower attrition rate than it would of larger aircraft less well armored. Is that not correct?

General SLAY. No, sir. You would have to assume equal lethality for that to be correct, equal lethality for each aircraft for that statement to be correct.

Senator THURMOND. Well, assuming equal lethality, then, would it be correct?

General SLAY. Then your statement is correct.

Senator THURMOND. If both can carry the same external payload from a forward field, the same mission radius, then they have equal capability to attack the same number of targets. Is that correct?

General SLAY. If you make that assumption, that is correct, sir.

Senator THURMOND. Now, isn't it true, if two aircraft have the same gun sights, speed range, same tactics, same maneuvering capability, and the same ordnance load, they have an equal capability to kill the same targets?

General SLAY. With those assumptions, and assuming equal vulnerability.

MAVERICK MISSILE ON CAS AIRCRAFT

Senator THURMOND. Isn't it true that a Maverick missile for killing tanks under one aircraft is no better and no worse than a Maverick under another aircraft?

General SLAY. No, sir. It depends upon the aircraft itself, sir, quite a bit. It depends upon the maneuverability of the aircraft, its own vulnerability, the capability of the weapons system, director system within the aircraft to bring its weapons to bear, lots of variables, Senator, so I cannot say that that statement as it stands is correct.

Senator THURMOND. Well, two aircraft carrying six Mavericks each and using the same gunsight as are outlined must have the same potential to kill the targets, assuming those factors I mentioned.

General SLAY. Yes, sir. You say it only has the gunsight, but the gunsight system itself could be intensely different. In other words, the sophistication of the sight itself, and the ability to bring it to bear. For instance, a gunsight system which has a rudimentary computation capability might be less capable than a gunsight which has a large computation capability.

Senator THURMOND. I would like to ask Mr. Helms his opinion of that.

Mr. HELMS. I interpreted the Senator's first question to be about the Maverick missile, not the airplane.

Senator THURMOND. That is correct, the Maverick missile.

General SLAY. The Maverick missile, once it is launched, is equally capable.

Mr. HELMS. And in the second one, I gather that the distinction that the general is drawing is between whether it is only a gunsight or a

Digitized by Google

gun-fired controlled system. If we assume one had a complete fire control system and one only a gunsight, obviously, I would agree with him, but if they both had the same fire control system which included the same gunsight, and assuming they both had the same maneuverability characteristics, because they do in the same speed range, then they must both have the same capability to kill the same number of targets.

Senator THURMOND. Well, would the Enforcer have those requirements that you just stated?

Mr. HELMS. Yes; it would. We expect it to have exactly the same system, Senator.

Senator THURMOND. Now, if I connect the prior questions and pose a situation whereby the small airplane which had a lower probability of being hit plus a lower probability of being killed and having the same capability with Mavericks to kill tanks, then that airplane must have a higher lethality than the second airplane. Is that not correct?

General SLAY. No, sir. I think the inference there is that the A–10 is more vulnerable to being shot down than the Enforcer. We do not under any circumstance agree with that.

Senator THURMOND. Mr. Helms, what do you say to that?

Mr. HELMS. I interpreted the Senator's question to be that if that situation existed, and I can understand the general's reluctance to acknowledge that the presentation I have just gone through shows that the A–10 is much more vulnerable, and if he elects to stay with that position, which is certainly his prerogative, then I can see why he might not agree with it, but under normal conditions, and based on the analysis that we have gone through today, which clearly establishes that the Air Force has at no time presented data on survivability which includes hit probability—they have completely ignored it—that I do not believe that his position of a higher resistance to vulnerability is valid. We have seen no data to support that whatsoever.

Senator THURMOND. Would you like to comment on that, General Slay?

VULNERABILITY OF ENFORCER AND A–10

General SLAY. Yes, sir. I categorically disagree with Mr. Helm's comment. We have been in this business a long time——

Senator THURMOND. He has, too.

General SLAY [continuing]. Estimating vulnerabilities, and we have the gentleman here who ran the study on vulnerability, as well as the detailed analysis that he refers to.

Mr. HELMS. I would only point out, Senator, that in the hearings held before the research and development subcommittee, the Air Force acknowledged that they did not include the probability of being hit in their equations. That was reflected in the testimony in the hearings of 29 and 30.

General SLAY. I would point out that the design of the A–10 has been such to absorb hits in noncritical areas. We know it is going to take hits, as any airplane will. I must agree that the larger the percentage cross-section of any airplane, the larger number of hits

Digitized by Google

that it will take. You will take more hits on the 747 than you will on th Enforcer and the A–10. That is absolutely a fact of life, but the point is, the A–10 has been so designed to lose a portion of its wing and still be able to recover from hits.

Certainly it can take hits in the outer panels of the wing, it can take hits in its fuselage, where there is no vulnerability to systems. It is an extremely complicated computation that has to be made. It is not, as Mr. Helms intends to convey, a simplistic computation at all. You must consider the vulnerable areas of the aircraft and the probability of hits in those vulnerable areas, and the capability of the airplane and its systems to withstand such a hit. You just cannot take——

Senator THURMOND. Which plane has the most vulnerable areas, the A–10 or the Enforcer?

General SLAY. The vulnerable areas, as far as our computations are concerned, the 14.5 millimeter using the A–7 as a baseline, the Enforcer has 70 percent as much vulnerable area as the A–7; the A–10 has 35 percent; 23 millimeter, again using the A–7 as the baseline of 1, the Enforcer has 30 percent of the vulnerable area of the A–7; the A–10 has 2 percent—57 millimeter, again using the A–7 as the 100 percent, the Enforcer is 62 percent; the A10 is 39 percent.

The SA–7, using the A–7 as a unity, the Enforcer has 68 percent, and the A–10 has 82 percent.

Senator THURMOND. Mr. Helms, would you like to comment on that?

Mr. HELMS. Well, I think that a number of items were covered. The Air Force acknowledged in their testimony that survivability, which is the basis of force level planning, is a function of hit probability and kill probability. The discussion through which the General just went was solely on vulnerability or the latter probability of kill, although he acknowledged the probability of hit should be included, or sometimes was, and I believe he acknowledged that the probability of hit on the A–10 might be larger due to size.

This was set aside.

General SLAY. I not only acknowledge, I assert that is a fact of life.

Mr. HELMS. The probability of hit is smaller, lower than the——

General SLAY. The lower the cross-section presented, the lower the probability of hit, without question.

Mr. HELMS. So therefore the Enforcer would have a much lower probability of being hit. I think the crux of the discussion, however, is on the probability of kill, as I understand this discussion. If we analyze the records going back to World War II, which is perhaps the best data that exists, particularly in the 8th Air Force and as applied by the 9th, 10th, and 7th Air Force, and brought up to date through Korea, we find that less than 3.5 percent of the aircraft shot down were shot down because their wing was shot off or a tail was shot off.

That is, basically less than 5 percent of the aircraft shot down are shot down because of a calamitous structure failure. They are all shot down because of subsystem failure, that is, fuel systems, or engines, or electronics, or hydraulics, and while it is noteworthy to design the airplane so that it can fly with part of the wing shot off or part of this, I submit that the Piper Cub which was designed 40 years ago was not designed with that requirement in mind and it can do it; in fact, it does

Digitized by Google

it routinely. We take the wing tips off and call it an aerobatic airplane.

So, therefore, the idea that we adjust the structure and use that as the basis for survivability really does not hold water too well. So now we come back to subsystems, and in the case of the square footage, if we have two aircraft with two engines, we normally assume, then, that those two aircraft will have the same fuel system, the same two engines, the same thing going along the line, so that if we compare that with one aircraft that has one engine, we take an approach that says, we divide the two engine one in two, but of course you cannot do that.

The reason that you cannot do that is because the two-engine airplane must have cross-feed valves. It must have additional fuel filters. It must have additional selectors. In the case of the A–10, for example, it has a self-starting or a unit to start the aircraft which is located back under the fuselage. That is not armored. It has hydraulic lines going back to the tail, to the rudders and the elevator. That is not armored. It has hydraulic lines going out to the ailerons. That is not armored.

Most of the subsystems which we are talking about that result in aircraft being shot down are not armored. Now, I suspect—I do not know the aircraft in detail, but I suspect some of the major fuel valves, that is, the selector valves, do have armor around them. I am not in a position to say, but I do know that if you have an aircraft that is half the size, with the same weight of armor, that can put it around its critical components, then by the very nature of that, it has to have a higher resistance to vulnerability.

I would go one step further. In the last testimony, the Air Force representative was asked, what was the most critical item as regards vulnerability of the A–10, and he said, the engine. He was asked what is the next one, and he said, the other engine. Neither of the engines are armored on the A–10, to the best of my knowledge. That might be a good question to put to the Air Force.

I can take the area of the A–10's alone, just the engines on the A–10, those pods, and more than equate all of the vulnerability area of square footage in the entire Enforcer. We all have the same self-fueling tanks. So, I cannot agree with the General at all, Senator.

General SLAY. These are not my figures, Senator Thurmond, these are figures that were coordinated by the joint technical coordinating group, which is a triservice agency under the cognizance of DOD. These figures are their figures.

Mr. HELMS. I would like to make only one final observation on that. I think the general is perhaps right there that was the joint coordinating group. I would call his attention to a classified report that was used in deriving that which established a basis for failure, and inasmuch as it is classified, I would not go all the way through it, but I would call his attention to reference J in that report, which uses as a basis for comparison a helicopter rotor, and says, that equates to a propeller.

Gentlemen, by no stretch of the imagination can we do that, by no stretch, so that the report he refers to was not an examination of the two based on the physical characteristics. Again, it was based on parametric data. This was brought to the attention of the Air Force representative at the research and development subcommittee hearings last July a year ago, and that the report he is referencing concluded the Enforcer was one of the two most survivable airplanes in the world.

[A brief recess was taken.]

Digitized by Google

Senator THURMOND. This hearing was set up as an adversary hearing so we could hear from both sides because we feel the record should show the situation. You both talked about survivability and the probability of being hit. I have some questions I would like to propound on that subject.

SURVIVABILITY

General Slay, isn't it true the probability of being hit, plus the probability of being killed is the definition of survivability?

General SLAY. Yes, sir. In general terms, that is correct.

Senator THURMOND. Is the probability of being hit to a considerable extent a question of size?

General SLAY. That is correct.

Senator THURMOND. Is it a question of speed?

General SLAY. That is correct, sir.

IR AND RADAR SIGNATURE

Senator THURMOND. In regard to guided missles, is the radar signature primarily a question of size?

General SLAY. Not necessarily, sir. There are techniques to make aircraft radar size go down. For instance, we have small aircraft that have a much larger radar cross-section than the B–1.

Senator THURMOND. Do you have a comment on that?

Mr. HELMS. No; I would agree if you design the aircraft with that thought in mind—the B–1, which is a supersonic vehicle—that could be done. I don't think there is any question primarily radar signature is a function of size.

General SLAY. I have to disagree, sir. That is not technically accurate. It depends on the surface of the system; it depends on the angles of the system. In other words the presented area may be very small in physical area but it may have a tremendously large radar cross section. We have learned that in devising devices to make targets look small to radar, small TOW targets look like large airplanes. So it is definitely not all a function of size.

Senator THURMOND. It might be well if you compared the radar signature on the Enforcer and A–10.

General SLAY. I might add a propeller is one of the best radar reflectors in the world.

Mr. HELMS. I would agree with that. However, that is only through 19 degrees fore and aft, and it is nowhere near as good as two large verticals, or two engine pods.

General SLAY. Radar reflectivity of a propeller would be high in a close air support system, the situation of head-on, because you are attacking, or when you are pulling off and presenting your tail to them. During both of those conditions propellers give a tremendously large——

Senator THURMOND. Still in the area of guided missiles, as regard infrared signatures is the probability of being hit directly related to exhaust temperature and angle of approach to that exhaust?

General SLAY. Yes, sir, but it is also related to the amount of shielding of that exhaust.

Digitized by Google

less inches of other connections, subsystems, it will always have higher protection factors. It must have. It requires less subsystem length than a twin-engine airplane.

AIRCRAFT SIZE AND ARMOR

Senator THURMOND. If one airplane is twice as large but carries the same amount of armor, again all other things being equal, the larger aircraft would be more vulnerable because of a thinner spread of armor over the area, is that correct?

General SLAY. That is not the way we would design it. If you assume you spread the armor around in places where you don't need armor, yes, sir, your statement could be correct, but no, again it is a matter of design, how do you design the armor to protect your critical components.

Mr. HELMS. I don't understand what the General is saying. The real question is whether in fact there are critical components put other places. I gather he is acknowledging the A–10 does not have armor on hydraulic systems going outside the other systems.

Mr. LINDSAY. I had occasion to work on the survivability study of the Enforcer, and it was done by one of the service groups. One of the things I think is vital to put in to these questions is the fact the A–10 has a hydraulic controlled system with all the hazards that that brings up. The Enforcer has a system of controls of surfaces by stainless steel cables. The Navy comment was that those were so unlikely to be damaged that they questioned the fact that I had designed redundancy. In other words, dual stainless steel cabling. I preferred to leave the dual controls, but there is a quantum difference in vulnerability of the controls.

A–10 REDUNDANT CONTROL SYSTEM

General SLAY. I think we have General Brill here who is program director, and knows the A–10 better than most people. Perhaps he could explain the system that we have for control in the A–10.

General BRILL. If I could address that question. We have a dual hydraulic system in the A–10 and we also have a manual reversion system. In the event that both hydraulic systems are shot out we have a manual system, so we have dual backup.

General SLAY. What he is saying, we not only have the cable arrangement that Mr. Lindsay referred to in the Enforcer, we also have the dual hydraulic system as the primary.

Mr. HELMS. I would like to know if the airplane can complete its primary mission with the manual system.

General BRILL. No, it can't, Mr. Helms. That is a get-home system in the event you are hard hit in combat and lose both separate hydraulic systems.

Mr. HELMS. If one of the two wire systems in the Enforcer were shot out it can complete its mission. I would also like to ask if we have concluded as a result of the dual hydraulic system we have redundant reliability. Is it acknowledged this reliability will go up by a factor of 4 in man-hours per maintenance flight hour, inasmuch as we must now maintain 200 feet of hydraulic lines and connections?

Senator THURMOND. Would you comment on that?

Digitized by Google

Senator THURMOND. Do you agree to that?

General SLAY. No, sir.

Senator THURMOND. If one aircraft has a low infrared signature ould not its probability of hit be lower?

General SLAY. By an infrared missile, correct?

Senator THURMOND. If one aircraft had an infrared signature one-alf or one-fourth or one-tenth that of another aircraft would not its robability of being hit be accordingly generally speaking one-half, ne-fourth, or one-tenth?

General SLAY. For an infrared missile, that is correct, sir.

Senator THURMOND. How would you compare infrared signature n the Enforcer and A–10?

General SLAY. On a scale of 0 to 1 with A–7 being 1, the Enforcer is 0.68, and the A–10 is 0.82. That is a rough comparison simply because of the presented area.

Senator THURMOND. Do you have a comment on that?

Mr. HELMS. I guess my comment is I am aghast. With the temperatures we were talking about, the exhaust temperatures—which is the source of infrared signatures—I would love to see the equation whereby that was derived. No, sir, I could not accept that under any basis.

Senator THURMOND. If we had an airplane with a low probability of being hit, say one-half the size and one-half the probability of being hit because it has half the radar signature, and one-half to one-tenth lower probability of being hit because of its low infrared signature, that airplane must have a probability of being hit considerably less than one-half the other airplane. Isn't that true?

Mr. HELMS. That is correct.

VULNERABILITY

Senator THURMOND. I have a few questions here on vulnerability.

Is it true with other things being equal that two aircraft of the same size with the same armanent will have the same probability of being killed?

General SLAY. Not necessarily, sir. Again it depends on the vulnerability of the inside of the airplane. Where the armor is placed, how it is placed, and the vulnerability of specific components in the airplane. I don't think you can draw a direct comparison unless you know the details of how the airplane is designed.

Senator THURMOND. Do you have any comment, Mr. Helms?

Mr. HELMS. To the extent the Senator's question was saying all other things being equal then they have to be the same, but within the context of the General's answer, if you allow some variation within the internal configuration I could understand why his answer would be postulated that way. There could be variance under that condition.

Senator THURMOND. If one of the two is twice as large the larger airplane that had the same probability of kill must carry twice as much armor. Is that correct?

General SLAY. Not necessarily.

Mr. HELMS. The answer would be the same. That if the two had the same subsystem level, keeping in mind a single engine airplane will always have less inches of electrical wires, less inches of hydraulics.

Digitized by Google

less inches of other connections, subsystems, it will always have higher protection factors. It must have. It requires less subsystem length than a twin-engine airplane.

AIRCRAFT SIZE AND ARMOR

Senator THURMOND. If one airplane is twice as large but carries the same amount of armor, again all other things being equal, the larger aircraft would be more vulnerable because of a thinner spread of armor over the area, is that correct?

General SLAY. That is not the way we would design it. If you assume you spread the armor around in places where you don't need armor, yes, sir, your statement could be correct, but no, again it is a matter of design, how do you design the armor to protect your critical components.

Mr. HELMS. I don't understand what the General is saying. The real question is whether in fact there are critical components put other places. I gather he is acknowledging the A–10 does not have armor on hydraulic systems going outside the other systems.

Mr. LINDSAY. I had occasion to work on the survivability study of the Enforcer, and it was done by one of the service groups. One of the things I think is vital to put in to these questions is the fact the A–10 has a hydraulic controlled system with all the hazards that that brings up. The Enforcer has a system of controls of surfaces by stainless steel cables. The Navy comment was that those were so unlikely to be damaged that they questioned the fact that I had designed redundancy. In other words, dual stainless steel cabling. I preferred to leave the dual controls, but there is a quantum difference in vulnerability of the controls.

A–10 REDUNDANT CONTROL SYSTEM

General SLAY. I think we have General Brill here who is program director, and knows the A–10 better than most people. Perhaps he could explain the system that we have for control in the A–10.

General BRILL. If I could address that question. We have a dual hydraulic system in the A–10 and we also have a manual reversion system. In the event that both hydraulic systems are shot out we have a manual system, so we have dual backup.

General SLAY. What he is saying, we not only have the cable arrangement that Mr. Lindsay referred to in the Enforcer, we also have the dual hydraulic system as the primary.

Mr. HELMS. I would like to know if the airplane can complete its primary mission with the manual system.

General BRILL. No, it can't, Mr. Helms. That is a get-home system in the event you are hard hit in combat and lose both separate hydraulic systems.

Mr. HELMS. If one of the two wire systems in the Enforcer were shot out it can complete its mission. I would also like to ask if we have concluded as a result of the dual hydraulic system we have redundant reliability. Is it acknowledged this reliability will go up by a factor of 4 in man-hours per maintenance flight hour, inasmuch as we must now maintain 200 feet of hydraulic lines and connections?

Senator THURMOND. Would you comment on that?

Digitized by Google

General BRILL. I can't comment quantitatively on that, but my judgment is we have had 3,000 psi hydraulic system for some time. We have not experienced hydraulic problems in the A–10. We have over 3,600, almost 4,000 flying hours on the operational aircraft. I think no question about greater length of lines—the more chance——

Mr. HELMS. For the record, the joint strategic survey at the end of World War II used the B–17 as an example and took four other airplanes and clearly established the man-hours per maintenance flight hour and operational flight hour boils down to inches or feet of electrical wiring, hydraulic lines, fuel lines, et cetera; and I know of no one today that could take exception with that.

Senator THURMOND. Any comment on that?

General BRILL. No, sir.

Senator THURMOND. I presume then the smaller aircraft, if it has thicker armor, would have a higher resistance to kill, is that correct?

General SLAY. Again I would have to state that it depends on where you put the armor, how you designed it, and what kind of armor you have.

Senator THURMOND. Are you familiar with the armor on the Enforcer as well as the A–10?

General SLAY. Yes, I am. I received briefings on it. I have seen the results of the tests and the results of the tests showed about an 8 caliber spread in damaged area with the flight dynamics lab test. I have the man here who ran the tests. The damage area on the Bristol armor extended out to about 8.15 inches versus an inch on the titanium armor on an equal weight basis.

Senator THURMOND. Do you have any comment, Mr. Helms?

Mr. HELMS. No, sir; we have not been given the data as a result of these tests, but coming back to an earlier one, as a result of those tests we have seen photographic evidence that Bristol armor can be repaired in about 10 minutes in a high-intensity conflict. The critical item is how rapidly you can turn that airplane around, literally ground crews wait with bombs ready to get in on the airplane.

I can't help but wonder what the time required would be to repair the damage on the A-10, and that armor is to provide equal level of protection for second, fourth, fifth, and subsequent sorties.

SURVIVABILITY OF ENFORCER COMPARED TO A–10

Senator THURMOND. In view of the smallness of the Enforcer, in view of the armor that it contains—Bristol armor that they testified to here—and the other features of that—would you say it is more survivable or less survivable than A–10?

General SLAY. Less.

Senator THURMOND. Would you tell why?

General SLAY. Yes, sir.

Because of the survivability features we have built in to the A–10, because of the capability of the armor that is in the A–10 to protect its own critical components. It is just a tough airplane, Senator, and I could not agree, based on what I know about that system, and what General Stewart's testimony has been about the Enforcer and the results of the test that the flight dynamics lab has run. I could not agree that the Enforcer is less vulnerable than the A–10. It just does not stack up to me, Senator.

Digitized by Google

Senator THURMOND. Mr. Helms, do you want to express an opinion on that?

Mr. HELMS. I do not know the details of the A–10. My information is that it is only armored around the pilot and in certain selected areas of fuel valves. If that is an error it is obviously an error. But if that is the truth or it is even close to the truth then by no stretch of the imagination can I equate 1,500 pounds of armor on an airplane half the size to having equal to or less vulnerability than one twice that size. There is no mathematical ratio to establish that because structural failure is not the way we lose airplanes.

As I said earlier, the data shows airplanes are not shot down but rarely because you shoot a tail off, they are shot down because of subsystems. The A–10 is so large it could not have armored protection over all the subsystems to the point where it could complete its mission. The primary axiom is, you did not do it; it was worthless if the bomb did not go on the target, and it cannot complete its target if it loses it hydraulic sysem.

General SLAY. The Enforcer has hydraulic ailerons.

Mr. HELMS. That is correct, they do have. But the mission can be completed without it. You cannot do it as well. He is absolutely right.

Mr. LINDSAY. I would like to enter a correction there. We have considered at the suggestion of Lockheed hydraulically boosting the ailerons on the Enforcer, but at this time they are not hydraulically boosted. They are controlled by stainless steel cables, and we are giving some consideration to using a similar system to the A–10 with spoilers on the top of the wing to augment turn capability of the Enforcer.

Mr. HELMS. We must be fair with General Slay. When we look at the rolling velocity parameters, and what we refer to as PB over 2V, I think I would have to agree with General Slay that we would probably end up with a hydraulic boost backup, but that is for only a critical portion of the envelope. It does not mean we could not complete our mission without it.

PAVE COIN TEST

Senator THURMOND. Now, a few questions here on the Pave Coin test.

General Slay, I believe the Air Force has tested the Enforcer 1971 in the Pave Coin test. Is that true?

General SLAY. That is correct.

Senator THURMOND. What was the recorded maintenance hour per flight hour?

General SLAY. I can't answer that. I will have to provide it for the record.

Senator THURMOND. What was the rate of consumption of spares, fuel pumps, and propellers, and so forth?

General SLAY. Same, sir.

Senator THURMOND. What were the maximum numbers of sorties per day for four airplanes?

General SLAY. I don't have that data with me, Senator. I would have to provide that for the record.

Senator THURMOND. Why was the Enforcer limited to two sorties per day?

General SLAY. I can't answer that, Senator, I don't know.

Digitized by Google

Senator THURMOND. You don't have your tests with you?

General SLAY. No, sir; I do not. Does anyone here know the answer to that? I am sorry, Senator.

Senator THURMOND. Do you have that information?

General BOND. Yes. The tests covered the entire spectrum of the things you discussed. It has been some time since I read the Pave Coin results, but I can provide all of that for the record.

[The information follows:]

The Pave Coin program was conducted by the Air Force in 1971 to identify and evaluate off-the-shelf forward air control and light strike aircraft (LSA) for possible subsequent procurement and delivery to military assistance program (MAP) countries.

The light strike aircraft portion of Pave Coin consisted of an evaluation of existing data on all candidate aircraft plus a flight evaluation of two of the candidate aircraft for which additional data were required. Evaluation data were obtained from Air Force sources for those aircraft already in Air Force or MAP inventories and from the contractors for the other aircraft. The flight evaluation phase was designed primarily to investigate aircraft handling qualities and obtain limited aerodynamic performance data for the "clean" aircraft configuration and various other typical light strike aircraft munitions configurations. Additionally, operational suitability, safety of carriage and general training requirements were assessed for the various aircraft configurations. Flight test missions were planned to check and correlate, insofar as possible, data provided by the contractor.

Pave Coin did ont have as its objectives a quantitative determination of required maintenance man-hours per flying hour, rate of consumption of spares, fuel pumps, propellers, etc., nor was there any requirement to determine sortie rates for the candidate aircraft.

Senator THURMOND. My information is the tests did not cover that, but if you have information to the contrary——

General BOND. Senator Thurmond, the test was not designed to cover a total spectrum of maintenance man-hours per flying hour or sortie rates or those types of things. The test was designed to evaluate potential capability of those aircraft in certain roles.

In the portion of the test that the Enforcer was evaluated in it was in a light strike aircraft role, and to my knowledge we do not have any records that identify or show an intent to identify sortie rates. It was a planning factor on what the test organization felt would be attainable by those aircraft that were being evaluated.

Senator THURMOND. Would you feel it important to know the maximum number of sorties per day?

General BOND. No, sir, I would not.

Senator THURMOND. That is not important, number of sorties that would be made a day.

General BOND. In a combat environment. The number of sorties that it could do in a production or combat configuration, yes, sir, that would be important. In discussing it in the Pave Coin environment, it is my personal judgment that would not contribute to some evaluation of the aircraft in its production configuration.

ENFORCER AGAINST HIGH PERFORMANCE FIGHTERS

Senator THURMOND. What is the Enforcer capability and air defense against the high performance fighters?

General BOND. My personal view is essentially none.

Senator THURMOND. Do you have any tests on it?

Digitized by Google

General Bond. No, sir, we do not. The aircraft, we are dealing with is a paper airplane and we can put any capability in that airplane. The airframe will carry it, as testimony has shown, and certainly we could incorporate into that aircraft a computing sight that might compute for the gun systems in air-to-air or we might install certain air-to-air missiles on that aircraft that could aid in an air-to-air role. The gunsight that is in the airplane today, projected to be in the airplane, is designed, as I understand it, with a HUD. That is essentially the same as in the A–7 and does not have an air-to-air computing sight. In striking air-to-ground targets or shooting against helicopters there would be some capability there, but not significant.

Senator Thurmond. I believe we had actual planes in test, didn't you?

Senator Bond. There were planes flown in the Pave Coin test.

Senator Thurmond. Was the average bombload carried by the Enforcer from forward fields?

General Bond. Are you speaking to the Pave Coin test?

Senator Thurmond. Yes.

General Bond. It was sortie loads generated by the test team to evaluate all the aircraft that were entered in response to the proposal.

[The information follows:]

All of the light strike aircraft evaluation missions flown by the Enforcer in the Pave Coin program were flown from Eglin AFB, Fla., not from a "forward field." A variety of external load configurations considered representative of light strike mission loads were flown. The stores flown included various combinations of rocket pods/rockets (LAU–59/68), flares, SUU–25), napalm cannisters (BLU–27), general purpose bombs (MK–82, M–117) and cluster bombs (CBU–14).

Mr. Lindsay. If I may—I was there. There were no operations from forward fields, only Eglin Main.

Senator Thurmond. Was the Enforcer as a launching platform used in Maverick missiles engaging the tank targets?

General Bond. In that test we did not evaluate with the Maverick missile. The evaluations that were done were with what was existing at that time time and they were easily attachable and dropped from the various aircraft. There was a relatively minimum demonstration of aircraft capability and did not get into potential of any of the aircraft.

Senator Thurmond. You did not consider the Maverick missile?

General Bond. No, sir.

Senator Thurmond. In the sense it now carries a Maverick missile a decision could be different then?

General Bond. The projected configuration of the airplane would have the capability to carry the Maverick. The aircraft as it exists today I don't believe does. Production aircraft could carry the Maverick missile, yes, sir.

Senator Thurmond. Now, what was the Army's opinion of the Enforcer's effectiveness in the 1971 test?

General Slay. We have an Army representative here today, sir. Colonel Munelli, and perhaps he can speak to that.

Senator Thurmond. What was the Army's opinion of the effectiveness in the Enforcer's test?

Colonel Munelli. Sir, the Army supports the Air Force position * * *

Digitized by Google

Senator THURMOND. I asked you what was the Army's opinion—if you don't know, say so—of the Enforcer's effectiveness in the 1971 test.

Colonel MUNELLI. Sir, The Army has no opinion of the 1971 Enforcer tests.

Senator THURMOND. I now go back to Air Force people. How much fuel per sortie did the Enforcer use in 1971, and how does that compare to the fuel of the A–10?

General SLAY. That is a detail I don't have. Perhaps General Bond does.

General BOND. No, sir, we do not.

[The information follows:]

The Pave Coin program did not have as one of its objectives a determination of the fuel used per sortie, therefore no such records were kept.

Senator THURMOND. The fact is, General, the Air Force does not have the information from the Pave Coin test to evaluate the present Enforcers; is that true?

General SLAY. No, sir; we have all that data, and General Stewart in his complete relook at the Enforcer did a total evaluation of the Pave Coin test and those results are available in the Pentagon. The entire Pave Coin test.

As I say, Lieutenant General Stewart who testified before this committee before, and who was referred to many times by Mr. Helms as giving misleading information to the committee, he did totally review that. And Mr. Rall here who is the chief engineer on that project I think could make a better comment than I could.

Senator THURMOND. Conditions evidently have changed since 1971 anyway, haven't they?

General SLAY. Yes, sir.

Senator THURMOND. And you heard the different weapons now on the Enforcer and so forth?

General BOND. Senator Thurmond, the Pave Coin evaluation was one facet of General Stewart's efforts to review the total Enforcer documentation. He evaluated the aircraft for its total effectiveness. He evaluated not the Pave Coin aircraft but a projected production version of the aircraft that was developed and presented by the developer of the Enforcer, Mr. Lindsay, and so General Stewart's evaluation was not a Pave Coin aircraft but close to a production version of the airplane. Since that time, since the time General Stewart did his evaluations there have become available new technologies, new things that could be incorporated into a production version of the Enforcer, and there might be some change to that configuration. Certainly it is different from what exists today, or what was evaluated.

Senator THURMOND. You heard Mr. Helms today so you understand there probably are changes since then.

Now, Mr. Helms do you have a comment on any of the questions I asked?

Mr. HELMS. No, I think to a great extent I could not have asked for anything better is that he exactly established that there were no tests for maintenance hours per flight hour, or support, or surge rates, and he noted that was a single prototype aircraft established or built to establish feasibility.

Digitized by Google

What we are requesting, of course, is a test program of four operationally configured preproduction airplanes, so I think he has exactly seconded the position we have taken.

There have been no tests by the Air Force. Therefore all the data in the computer model is generated from somebody's estimate.

General BOND. To fine line my articulation, I agree with Mr. Helms, but the configuration we evaluated was not on a Pave Coin configuration but on a proposed production configuration. I want to make that fine line of distinction. The Air Force determination is that it is not a cost effective weapon system to put into our inventory.

Mr. HELMS. I am aware of that. That came out clearly in General Stewart's testimony. He showed a genesis of developing models of the Enforcers. So I recognize that difference.

Senator THURMOND. Mr. Lindsay, do you have any comment?

Mr. LINDSAY. No, sir; I concur, the Pave Coin aircraft was quite different. It came along at a time when we were developing the present aircraft, and we had short notice, and we took the airplane up there to be represented as best we could. It was not what I would not consider an operational evaluation test. It was just a "look-see". Only two Air Force pilots flew it, and they flew limited missions. Both of these pilots have since testified before the Senate R. & D. Committee they think very highly of the airplane.

SENATOR THURMOND'S CLOSING STATEMENT

Senator THURMOND. I might just make one comment and then I am through. I sat here and listened today to the presentation by Mr. Helms and the Air Force, and the questions and the answers and responses. You have got sharp differences of opinion here on the part of Mr. Helms, who I understand is willing to build these prototypes, but not interested in producing the planes after that, and Mr. Lindsay on one side, and the Air Force on the other.

General Slay, I am sure you know Mr. Helms and his reputation as an aeronautical engineer and as an executive and so forth. It seems to me what has come out here today very definitely in itself indicates he takes positions to which you take exception, and you take positions to which he takes exception. You are both outstanding capable men in your fields, and if there is a possibility of saving the Government money here—building four planes instead of one—I don't know that it is—I have gone along with every weapon the Air Force has advocated, B-1, A-10, but I am beginning to wonder now if the Air Force should not consider this test to really get the facts, to get the truth.

One of you must be in error. How do we know who is in error? Why don't you conduct these tests. It wouldn't cost much. You conduct these tests for foreign weapons. I believe you got $3.4 million in the budget this year to conduct foreign weapons tests. The Army and the Navy conducted tests on foreign weapons. Why not conduct a test of a domestic weapon, of a man who spent his own money to develop a plane for his country, a man who has come up with a plane. He says it will do the job, backed up by Mr. Helms, the president of the Piper Company, a well-known company in this land that says it will do the job.

Digitized by Google

So what is the objection to conducting the test? Are you afraid something will come out that will embarrass the Air Force? Are you afraid of any information—are you afraid it will show up better than you think it will? Why not conduct the test? It does not cost much. We will get this matter settled, and if it should result in the fact that it is a worthwhile plane it could be a supplement to the A–10, it might be a very vital, especially in rough territory.

My understanding is the A–10 can only take off on paved runways. The Enforcer can take off in fields, sod fields, even muddy fields, a light plane, can take off anywhere. All we want is the truth. And all we want is the best weapons for the money. The American taxpayers, I would think, would strongly favor making a test to see if this thing is worthwhile, if it will improve our defense or it will save money, either one, and you might have a chance that it will do both.

So I would suggest the Air Force carefully consider going along with this test. That is all I have to say, Mr. Chairman.

A–10 GAU–8 GUN

Senator GOLDWATER. General, I have listened to this with a great deal of interest. I have had an interest in this airplane for a long time. I have also had an interest in air-to-ground support by aircraft for a major portion of my life. I have been very impressed with the carriage of 30 milimeter ammunition. In my humble opinion, any aircraft that can't carry that should not be considered for ground support.

Do you have that film with you?

General SLAY. Yes, I do.

Senator GOLDWATER. Could I see that?

General SLAY. These are preliminary shots of the A–10 taking off on its mission. This is the target array. This graphically illustrates the accuracy of this gun. We are getting four mils in accuracy operational tests.

I would also like to state a little about that gun, Senator. We are getting fantastic accuracy with it. It is more accurate than any gun we ever used in any circumstance, for air-to-ground work. We can take pilots who are quasi-trained and on their first mission, go out and with short bursts kill tanks. Four mils accuracy is just absolutely tremendous accuracy for air-to-ground weapons.

Senator GOLDWATER. What is the physical size of this gun?

General SLAY. The physical size is about the length of a Volkswagen. It is a large gun about 21 feet long. Very large.

Senator GOLDWATER. How much does it weigh?

General SLAY. It has a total weight empty of 1,970 pounds plus the 30 millimeter ammunition, and 4,140 total; 4,140 pounds total with the 30 millimeter ammunition. That is with 1,350 rounds.

Senator GOLDWATER. Are you ready with the film?

[Film shown.]

General SLAY. These tanks were combat loaded. The film shows the A–10 dropping Rock Eye munitions. It is also a very effective tank killer. Almost every one of those hits penetrates the armor on the tank.

This airplane is extremely maneuverable. It brings guns to bear very rapidly.

Digitized by Google

This shows a view from the cockpit.

This is a Maverick missile being fired from the A–10. An extremely effective weapon.

I think this shows the concentrated fire of that gun. Very short burst is adequate to hit and kill.

Senator THURMOND. Why is it burning so?

General SLAY. It is a combat loaded tank, and it has tank fuel aboard.

This is a test in Germany. We were talking about the field capability of the A–10. We are operating out of Grafenwohr airstrip. It is 3,200 feet long. You will notice the A–10 landing at Grafenwohr. This is the first jet airplane in there. He stops in less than a third of the length of the field.

I would like to correct a misapprehension about the A–10. It will be capable of operating off sod strips. The tests we have already conducted have shown its capability on CBR–8, which is about like a golf course fairway and we are currently planning for testing to CBR–6.

AIR FORCE PROCUREMENT PROCEDURE REQUIREMENT

Senator GOLDWATER. Now, General, let's assume that the Air Force needs this type aircraft. Wouldn't you be required to have companies like Beech, Cessna, Piper, Mooney, Grumman, Rockwell, all submit propositions on this?

General SLAY. We certainly would. We have had several unsolicited proposals already on aircraft of the type that the Enforcer represents. We are required by armed services procurement regulations to have competition where such competition is feasible, and it certainly is feasible in this case. Not only is it feasible, I think it would be required to assure that we get the most out of the taxpayer's money.

So to answer your question, it is the strong position of the Air Force that if we are to engage in a procurement of an aircraft of the nature of the Enforcer, that we would want to take advantage of the competitive environment and open this up to competitors as well as to Piper.

Senator GOLDWATER. What are we talking about in time?

General SLAY. Sir, it would take perhaps a minimum of a year to get this on the street, to get proposals back, and to get these proposals evaluated in order to have either a flyoff or a direct entry into full-scale development. Then the full-scale development would take another perhaps 3 or 4 years.

Senator GOLDWATER. Would you make a presentation to the Air staff—in fact it should go to the Joint Chiefs—asking their opinion on this, and let's get a final decision so this does not come up year after year after year. I know these gentlemen have spent a lot of their time, and a lot of their money on it. If the services do not want it, I think that should be made clear. If they do want it, I think the decision should come from the staff, and we should get on with the job of putting it out for general bid. Can you do that?

General SLAY. I will be most happy to.

[The information follows:]

Digitized by Google

THE JOINT CHIEFS OF STAFF,
Washington, D.C., April 8, 1977.

HON. HOWARD W. CANNON,
U.S. Senate,
Washington, D.C.

DEAR SENATOR CANNON: This responds to your letter requesting the judgment of the Joint Chiefs of Staff on whether there is a requirement for the Enforcer aircraft in the U.S. tactical air forces.

It is the judgment of the Joint Chiefs of Staff that there is no requirement for the Enforcer in the U.S. tactical air force inventory. That judgment has been supported by an extensive review of the Enforcer proposal, including the capabilities and vulnerabilities of such an aircraft in the predicted threat environment used in structuring tactical air forces. Each of the Services is constantly seeking systems which will provide the most effective combat capability at the least cost. Given the spectrum of conflict which must be considered in force structuring, the growing sophistication of the Soviet threat, and budgetary constraints, cost effectiveness of each system becomes paramount. The Joint Chiefs of Staff believe the fighter/attack aircraft in the current inventory plus those programmed for procurement best fit that criterion. The United Sates cannot afford to hedge its bet by further procurement of a highly specialized aircraft, however inexpensive, when thorough review of all analysis to date shows it not to be as cost effective or survivable as other aircraft already being procured.

Further, the Joint Chiefs of Staff can see no requirement for building or for operational testing of prototypes of the Enforcer. Specific capabilities of the Enforcer have not been at question in previous analysis. The technology embodied in the aircraft and its systems makes its operational characteristics predictable with confidence.

The Joint Chiefs of Staff trust this will establish clearly their position concerning the Enforcer aircraft.

For the Joint Chiefs of Staff,

GEORGE S. BROWN,
Chairman, Joint Chiefs of Staff.

Mr. LINDSAY. Since this is set up on an adversary basis, and since I am the designer of the Enforcer, may I ask a few questions of the General and call on one member of our team?

Senator GOLDWATER. I had just one statement.

The subcommittee rules require the prepared testimony be submitted 6 days in advance of the hearing. The Enforcer testimony today was not submited in advance. It makes some serious charges about the validity of the Air Force analysis of the Enforcer, so I will leave the record open, and General, you may submit any comment you have for the record.

General SLAY. We would appreciate that opportunity, Senator.

[The information follows.]

This Air Force position paper has been written to correct the errors and clarify the erroneous statements made in the 16 March 1977 Tactical Air Subcommittee testimony on the Enforcer aircraft by Messrs. Lindsay and Helms. The paper is organized into the following sections: I. Vulnerability and Survivability; II. Costs; III. Pave Coin; and IV. A-10.

I. VULNERABILITY AND SURVIVABILITY

The 16 March 1977 Tactical Aircraft Subcommitee testimony on the Enforcer aircraft by Messrs. Lindsay and Helms reflects a serious misunderstanding of aircraft vulnerability and survivability. As a result, the "analyses" presented in their prepared statements do not reflect accurate interpretations of the physical realities. The following discussion will correctly reflect the facts on vulnerability and survivability.

Vulnerability.—The official definition of vulnerability is:

"The characteristics of a system which cause it to suffer a finite level of degradation in performing its mission as a result of having been subjected to a certain level of threat mechanisms in a man-made hostile environment."[1]

[1] "Aircraft Nonnuclear Survivability/Vulnerability Terms," Report JTCG/AS 74-D-002, Oct. 76.

Digitized by Google

Vulnerability then is a physical characteristic of the aircraft itself after it is hit by whatever threat is being considered. Thus, by definition, aircraft vulnerability does not consider the probability of being hit. That consideration is discussed later under Survivability.

There are four basic methods of obtaining an aircraft design with low vulnerability. These are: (1) Explosion suppression and fire prevention, (2) self-protection, (3) redundancy, and (4) armor.

Explosion suppression and fire prevention can be incorporated into the design by providing space, fuel tankage configurations, and line routing in, and adjacent to, flammable fluid containers so as to minimize the damage from potential explosions caused by a hit and to minimize the probability of a resulting fire.

Self-protection is obtained by placing critical components so that they are shielded from the threat by non-critical items or items which themselves are protected. An example of this is the routing of fuel lines within the protected fule tanks themselves. The fuel tanks, being protected, absorb the threat effects and prevent catastrophic damage to the lines. Another example is the mounting of critical components so that they are shielded by aircraft structure.

Redundancy provides back-up capability for critical flight functions. In order to be effective, redundancy must include sufficient distance between redundant components so as to preclude a single round from destroying the functions of both items. This technique is clearly seen in the A–10 design from the wide separation of the engines, routing of redundant flight control and hydraulic lines down opposite sides of the fuselage, wide separation of the dual vertical tails and rudders, and redundant structural members such as wing spars.

Armor is in general the least desirable vulnerability reduction technique because of its large weight penalty. However, there are occasions when armor is the only feasible alternative. Protection of the pilot is one example. Selection of the type of armor is based upon minimum weight, volume, cost, multiple hit capability, and repairability to defeat the threat. Actual tests of available armors prove that the titanium armor in the A–10 is better in all categories than the armor proposed for the Enforcer. Specifically, the ballistic limit velocity is higher for the A–10's titanium armor; damage to the A–10's titanium armor is more localized and repair is more efficient than on ceramic armor. Furthermore, titanium is approximately one half as thick as ceramic armor for the same density.

In summary then, vulnerability reduction is obtained through numerous design techniques, the least desirable of which is armor. Thus, an aircraft that has twice the presented area of another and incorporates these low vulnerability features from the beginning of the design process may easily have half the vulnerable area of the second aircraft. Comparing airplanes on the percent of armor incorporated denies the realities of vulnerability.

Survivability.—The offiical definition of survivability is:

"The capability of an aircraft to avoid and/or withstand a man-made hostile environment without sustaining an impairment of its ability to accomplish its designated mission.'[2]

In simpler terms, suvivability includes the following terms:

(1) Probability of being detected, tracked and fired at by the threat.

(2) Probability of being hit when fired at.

(3) Probability of being killed when hit. (This is the vulnerability term which has been discussed previously.)

Probability of being detected, tracked and fired at by the threat.—The primary detection devices are radar, infrared sensors, and optical devices such as binoculars. Minimizing the observable signature in these areas, however, does not reduce the probability of being detected unless the signature is reduced below the sensitivity of the detection device. For example, if an aircraft infrared signature is sufficiently large to be detected at ranges sufficiently long to allow threat system operators to prepare for firing, then a larger IR signature has no relative disadvantage. Thus, comparisons of absolute signature size are meaningless and misleading unless compared to the sensitivity of the detection dvices. The radar and IR signatures of both the A–10 and Enforcer have been assessed and have been properly used in the scenario presented by the USAF. Credit has been given

[2] "Aircraft Nonnuclear Survivability/Vulnerability Terms," Report JTCG/AS 74-D 002, Oct. 76.

Digitized by Google

to the Enforcer for its smaller infrared signature, and an accurate assessment of the radar signature has been used which includes the large radar return from the propeller.

Probability of being hit when fired at.—This item includes many factors such as speed, maneuverability, counter-measures, etc. Because of the complexity involved in this subject, and the thrust of Messrs. Lindsay's and Helm's testimony, only one portion will be discussed here, namely the question of if an aircraft which is twice as large is twice as likely to be hit when fired at. To examine this case, we have looked at two aircraft, one the A–10 and the other the Enforcer, flying at 3,500 feet slant range to a ZSU 23mm AAA gun. Using the actual dispersion characteristics of the gun, the probability of being hit during a typical 40 round burst is only 25 percent less for Enforcer than for the A–10. The reason for this is that the gun accuracy is sufficiently high that the probability of hitting the smaller Enforcer approaches that of the larger A–10. It is totally misleading, therefore, to judge the probability of being hit on the basis of size alone without taking into account the accuracy of the threat weapon.

In summary:

Aircraft vulnerable area cannot be "deduced" from simple ratios of aircraft size, armor weight versus aircraft empty weight, or aircraft wetted area.

The Bristol ceramic composite armor performer approximately as claimed; however, this is not as good as the titanium (6A1–4V, ELI) armor used in the A–10.

A–10 vulnerability to the predominant threat (23mm HEI–T) to close air support aircraft is less than the Enforcer and correspondingly, A–10 survivability to this threat is higher.

The Air Force evaluation of Enforcer and A–10 attrition properly and fairly accounted for probability of hit and probability of kill given a hit.

Incorrect interpretation of basic vulnerability and survivability concepts led Messrs. Lindsay and Helms to erroneous conclusions regarding Enforcer versus A–10 comparisons. In fact, the reliance on armor weight as a quantitative measure of vulnerability resulted in conclusions on their part which were completely contrary to conclusions based on detailed analyses.

II COST

Prototype

The Air Force estimate expressed in 1977 dollars for a four aircraft prototyp program is $18.5 million as compared to Mr. Helms' estimate of $10.6 million. The Air Force estimate includes $1.20 million for AFTEC operational tests, $1.30 million for adding Heads-up Display, $1.30 million for adding the 106 mm guns and $1.20 million for engineering changes and management reserve. If Mr. Helms' estimates were increased to account for these elements, his estimate would be $15.6 million, within less than 15 percent of the Air Force estimate for the prototype program.

Full-Scale development

The Air Force estimate for the full-scale six aircraft development program is $157.0 million (1977 dollars), as compared to Mr. Helms' estimate of $78.0 million. Mr. Helms states that his $78.0 million estimate is within 6 percent of the Navy estimate for a full-scale development program for the Enforcer. The Navy estimate is $62.7 million expressed in 1973 dollars. If this figure is increased twice by a $15 percent factor for escalation to 1977 dollars, the result is, in fact, an estimate of 6.3 percent higher than Mr. Helms' estimate. However, the Navy estimate is for a four (4) aircraft program while Mr. Helms' estimate is for a six (6) aircraft program. The Navy estimate of $62.7 million is broken down as follows:

	1973 dollars in millions
Nonrecurring development	$48.5
Recurring flyaway (4 aircraft)	14.2
Airframe	(13.0)
Engines (including propeller and gear box)	(.8)
Avionics	(.3)
Other GFE	(.1)

Discussions with the Navy reveal that they believe they should have included a total of at least six test aircraft and that they were optimistic, if not in error,

88-387 O - 77 - 42

Digitized by Google

in deleting $12 million for consideration of recoupments from P–51 data and tests. Adding the $12 million back into their estimate, adjusting to six test aircraft, and escalating to 1975 dollars (per Navy escalation rates), results in a full-scale development program estimate of $104.3 million in 1975 dollars, or $126.1 million in 1977 dollars. Therefore, the Air Force estimate of $157 million is 25 percent greater than the Navy estimate and the Piper estimate of $78 million is 38 percent lower.

Production

The Air Force does not necessarily disagree with the Piper production flyaway estimate of $902,000. The Air Force does object, however, to the comparison of the $902,000 with any Air Force flyaway estimate—they are not comparably defined. Mr. Helms testified on 22 May 1975: "When I use the term flyaway price, I mean that (the) aircraft can be flown away from our factory, loaded with ordnance and started into combat." Piper had previously stated in testimony and the Piper document "Piper Aircraft Corporation Enforcer CAS Aircraft Projected for 1975 Prices, 400 and 700 Aircraft," (no date) that the flyaway cost does not include avionics, HUD, provisions for a missile (e.g., Maverick), and probably does not include 50 cal guns. In other words, the Piper flyaway aircraft is not a combat-ready system.

To make production flyaway estimates of the Air Force and Piper comparable, the following adjustments to the Piper estimate must be made, using Air Force estimates for adjustments expressed in millions of dollars:

Piper estimate (1975 dollars)	$0.783
Program adjustment (production rates)	.117
Escalation from 1975 to 1977 (.33[1])	.297
Avionics (1977 dollars)	.044
HUD/Maverick (1977 dollars)	.220
Armament (1977 dollars)	.036
Total adjusted flyaway (1977)	1.497

[1] Latest escalation index (1975=1) weighted for consideration of DOD expenditure patterns.

The above total adjusted flyaway estimate is now considered by the Air Force to be comparable to the Air Force flyaway estimate of $1.62 million in 1977 dollars for a buy of 733 aircraft. The two estimates are within 7.5 percent of each other—a satisfactory test of reasonableness for either estimate.

The Air Force wishes to set the record straight on the number of Enforcers which can be bought for one A–10 by presenting the following table (millions of then year dollars):

	Air Force A–10 cost estimates	Air Force Enforcer cost estimates	Enforcer to A–10 ratio
Unit flyaway	$4.824	$2.21	2.18:1
Unit program [1]	6.121	2.97	2.06:1

[1] Includes total prototype program plus full-scale development program plus production program (including initial spares) divided by 743 aircraft (4 prototype plus 6 full-scale development plus 733 production aircraft).

III. PAVE COIN

Mr. Lindsay stated that the purpose of the PAVE COIN Evaluation was to select a close support attack aircraft for the Vietnamization Program and to replace the highly regarded A–1 Skyraider. Further he stated that the intent of the Air Force was to select and procure aircraft in at least minimum quantities set forth in the Request for Proposal. In fact, the DOD directed PAVE COIN Evaluation was to identify and evaluate existing aircraft suitable to perform Forward Aircraft Control (FAC) or Light Strike Aircraft (LSA) missions

Digitized by Google

for MAP countries faced with counterinsurgency. The evaluation was to identify and evaluate candidate aircraft which met the established criteria and which could be considered for future source selection and/or procurement which might have been directed. It was not a source selection. Additionally, candidate aircraft, which were in the Air Force or MAP countries' inventories, were not required for a flight evaluation since their flight characteristics were already known. All aircraft participated in a paper evaluation.

Five candidate aircraft were evaluated for suitability as light strike aircraft. The Super Pinto and the Enforcer were flight evaluated at Eglin AFB during 10–19 August 1971. The A–37B and two versions of the OV–10 were evaluated on paper only since these aircraft were in the USAF inventory and had been extensively flight tested.

From an operational standpoint, no one aircraft was clearly superior. The aircraft were prototypes and did not contain all the features of the proposed production aircraft.

Technically, the PAVE COIN Evaluation found all five aircraft not acceptable, without some redesign and substantiation testing.

IV. A–10

Offrunway capability

The A–10 has demonstrated the capability to operate from unprepared fields. The Air Force showing the capabilities of various aircraft as a function of California Bearing Ratio (CBR) (Chart #3 in Mr. Helms' briefing) is accurate and reflects the relative capability of the aircraft.

It is true that tail wheel aircraft have certain advantages in operation from unprepared fields. However, there are also disadvantages to tail wheel aircraft, such as increased tendency to ground loop and poor visibility during taxi. The C–130 is an example of a tricycle type gear aircraft designed and operated very successfully from rough unprepared fields. The selection of gear design is a compromise between the advantages and disadvantages of the various options.

Mission performance

Mr. Helms has failed to bring out the impact on the performance capability of adding a given payload on a 11,000 lb. aircraft such as the Enforcer as compared to an aircraft such as the A–10. The impact of adding payload to the Enforcer is shown in Figures 1 and 2 and is summarized in the following table:

	S/L, standard day, 250 kts	
	Sustained load factor (g's)	Instantaneous load factor (g's)
Clean, full internal fuel	3.5	5.2
6 MK–82's, 2 ECM pods (350 lbs each) 600 lb ammunition	2.2	3.7

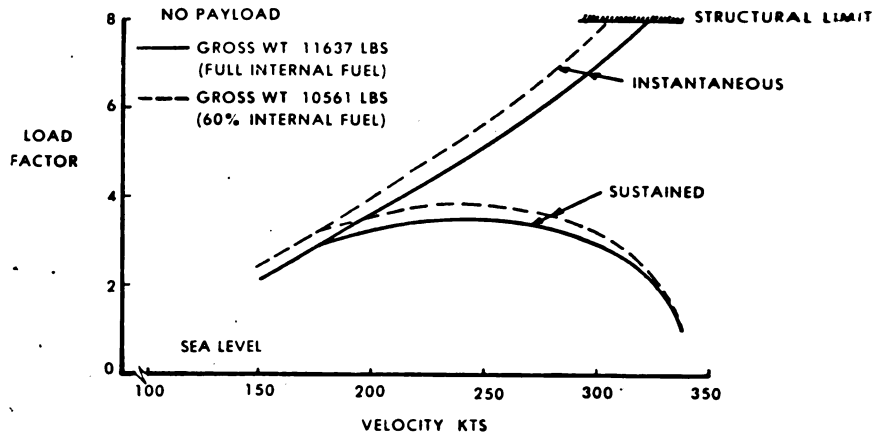
Thus a relatively small payload has a significant impact on the maneuverability of the Enforcer. This might have also been concluded by looking at the max design payload with full internal fuel of 3000 lbs. for the Enforcer vise the 10,000 lbs. for the A–10.

Mr. Helms quotes mission performance data on the A–10 supplied through the Congressional staff. It is obvious that a misunderstanding occurred somewhere in the communication chain since the A–10 data shown by Mr. Helms is entirely false. In fact, to verify the validity of the A–10 performance estimates, we recalculated the A–10 performance capability using the pilot's handbook and find that the performance numbers submitted by the Air Force in July 1975 are conservative when compared to more recent data.

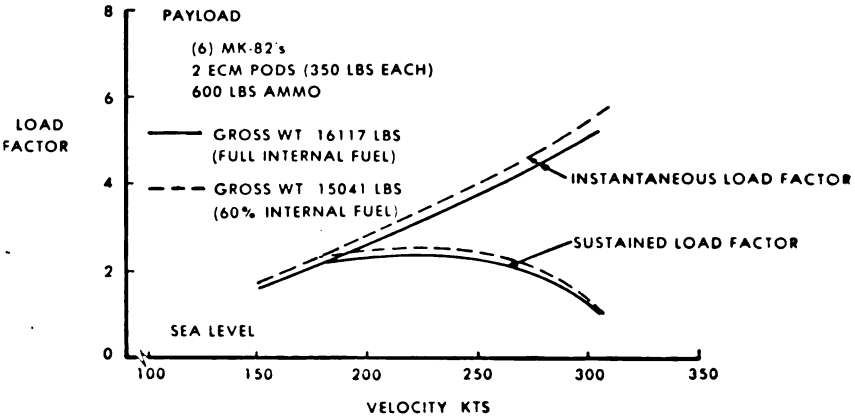
[Figures 1 and 2 follow:]

Digitized by Google

LOAD FACTOR CAPABILITY
ENFORCER AIRCRAFT



LOAD FACTOR CAPABILITY
ENFORCER AIRCRAFT



Mr. LINDSAY. Senator, if I may.

30 MILLIMETER AMMUNITION EFFECTIVENESS

General, is it your position that the NATO standard DEFA 30 millimeter cannon is not capable of destroying a tank?

General SLAY. It is capable of destroying only certain tank configurations, configurations with external fuel tanks. My position is it is much inferior to the GAU-8 by a large amount.

Digitized by Google

Mr. LINDSAY. But there are those who would not agree with you, is that correct?

General SLAY. Particularly the designer of the DEFA.

Mr. LINDSAY. There have been some 10,000 produced. In regard to this tank film, which I have seen before, would it not be normal if you are seeking test of penetration of small caliber rounds 30-millimeter, would it not be normal to test that tank so you could inspect the results of the test and and see what your penetration was rather than setting it up like an Eglin Fire Power Demonstration where you use lots of fuel and lots of secondary ammunition?

General SLAY. We have done that. The record is clear as to what the 30 millimeter API will do to armor. We have run those tests on the ground against all types of armor that we have knowledge of. We have run it—at least it is available to us in quantity—we have run the tests on the range in the air as you saw just now. And those tanks are, of course, inspected subsequent to the tests. The tanks are not destroyed by the fire that you saw. We have run tests on tanks without fuel. So we know pretty well precisely what the 30-millimeter API round will do, and what it will not do.

Mr. LINDSAY. After the A–10 tour of Europe there was a report in Aerospace Daily that at no time during the demonstration tour, which included some 19 stops, was any ordnance carried. If operational tests would be held in the field with the Germans and our other allies, would it not be normal to configure the aircraft with inert ammunition similar to what might be expected in combat?

General SLAY. I am not sure what you are referring to, Mr. Lindsay.

Mr. LINDSAY. I am referring to the fact that the landing that was shown there, which was quite impressive, was done with no ordnance under the wings, and I am informed that the weight of the aircraft was very near its empty weight. In other words, it was quite low on fuel.

General SLAY. That is normally the state when you return from a mission. That was a landing after a mission, so you would normally expect to have it clean if it expended the munitions carried aboard.

Mr. LINDSAY. You are right. But in Europe with the troops in the field there would be, normally, simulated take-offs with so many Mavericks, so much ammunition. But the information in the foreign press is that at no time during the European tour was ordnance loaded on the A–10 for those demonstrations, which hardly seems to be impressive.

General SLAY. Perhaps General Brill would like to speak to this.

General BRILL. The intent of the European tour was to show the aircraft to certain foreign countries, our NATO allies, and at USAFE bases. It was more for orientation than—there was no intent to conduct operational tests. We did land on two short fields. The airplane was about 28,000 pounds. But there was no intent to have an operational test. We ran one mission to see how the airplane operated in a NATO exercise in limited weather.

Mr. LINDSAY. My last request is I might call an attorney with whom we consulted many years ago when we accepted this challenge which was put out by David Packard and which we took in good faith, to

Digitized by Google

endeavor to create a weapons system. And he is here now, and I think might discuss the ASPR's. I think armed services procurement regulations specifically encourage the private individual to invest his own money, and it provides for remuneration.

Senator GOLDWATER. I don't think there is any need of legal testimony. I will accept that. The record will accept it.

I wish that we had more participation by private industry. Unfortunately the cost of these pieces of equipment is so high it is our view the private individuals that can afford it—it cost you a bundle but it is not a bundle as the Federal Government looks at it—I think frankly that if we don't go to a light aircraft for ground support that we can seriously consider legislation that would help you get out of a financial dilemma.

What we are actually confronted with here in my opinion is the necessity of either the Joint Chiefs or the Air Force making up their mind whether they want this kind of an airplane.

Mr. LINDSAY. I am not so much interested in the money involved. I had, as you know, assistance from a number of other companies. But I do have quite a feeling for the 7 years of my life that I have been involved in this, at some slight personal risk, and I was advised by Mr. Loren K. Olson, of a reputable firm here, who is extremely familiar with armed services procurement regulation, that we were operating within the intent of the ASPR's, and I would appreciate if he might——

Senator GOLDWATER. I would be happy to allow him to submit testimony. The reason I say this it is coming up 1 o'clock and I have missed four other meetings this morning, which I am very happy to do.

[Letter from Mr. Loren K. Olson, counsel for Mr. David Lindsay, follows:]

MORGAN, LEWIS & BOCKIUS,
Washington, D.C., March 22, 1977.

Senator BARRY GOLDWATER,
Senate Armed Services Technical Airpower Subcommittee,
Washington, D.C.

DEAR SIR: At the hearings on the Enforcer close support aircraft on Wednesday, March 16, 1977, General Slay testified that the Armed Services Procurement Regulation (ASPR) would require that any procurement of the Enforcer be on an industry-wide competitive basis. He estimated it would take at least a year to get such a procurement "on the street". At that time Mr. David Lindsay, my client, requested that I be given an opportunity to rebut General Slay's statement, and you indicated that a written response could be submitted for the record.

There is no requirement of federal law that the Enforcer be procured by formal advertising or on a competitive basis. It is true that ASPR requires maximum feasible competition (ASPR § 1-300.1) and provides that purchases of supplies and services shall be made by formal advertising in all cases in which "the use of such method is feasible and practicable under the existing conditions and circumstances." (ASPR § 1-300.2). ASPR clearly contemplates, however, that procurement of privately developed items may be on a noncompetitive basis (ASPR § 1-304). The Air Force would have no problem procuring four Enforcers for flight test on a sole source basis, if it wished to do so. The Enforcer was fully developed with private funds and would be considered a "privately developed item" within the meaning of ASPR. As such, sole source procurement is authorized by ASPR § 1-304.2(b)(2).

While procurement is to be made by formal advertising when such method is feasible and practicable, procurement may be effected by negotiation pursuant to the authority of 10 U.S.C. § 2304(a) under one of the exceptions set forth in

Digitized by Google

ASPR. ASPR § 3-101(a). Negotiated procurements are conducted on a competitive basis to the maximum practical extent. ASPR § 3-101(d). Pursuant to 10 U.S.C. § 2304(a)(11), purchases and contracts may be negotiated if:

"For property or services that he [the Secretary] determines to be for experimental, developmental or research work, or for making or furnishing property for experiment, *test*, development, or research". (Emphasis added.)

ASPR includes the following illustration of circumstances to which the authority of this provision may be used:

"(iii) Contracts for such quantities and kinds of equipment, supplies, parts, accessories, or patent rights thereto, and drawings or designs thereof, as are necessary for experiment, development, research or *test*;" ASPR § 3-211.2(iii). (Emphasis added.)

In addition, pursuant to 10 U.S.C. § 2304(a)(14), purchases and contracts may be negotiated if:

"For technical or special property that he [the Secretary] determines to require a substantial initial investment or an extended period of preparation for manufacture and for which he determines that formal advertising would be likely to result in additional cost to the Government by reason of duplication of investment or would result in duplication of necessary preparation which would unduly delay the procurement of the property".

This authority may be used for the procurement of aircraft and other technical or specialized supplies. ASPR § 3-214.2. ASPR states that such procurement generally involves the following:

"(i) high starting costs which already have been paid for by the Government or by the supplier;

(ii) *preliminary engineering and development work that would not be useful to or usable by any other supplier;*

(iii) elaborate special tooling already acquired;

(iv) substantial time and effort already expended in developing a prototype or an initial production model; and

(v) important design changes which will continue to be developed by the supplier." *Ibid.* (Emphasis added.)

Procuring the four Enforcer aircraft for flight test purposes would clearly qualify as a purchase under circumstances which do not require formal advertising but permit negotiation.

Further reason for not conducting an industry-wide competitive procurement is found in the desirability of protecting contractors from public disclosure of technical data developed at private expense. The Department of Defense policy set forth in ASPR recognizes that public disclosure of technical data in the form of contract specifications prepared to obtain competition among suppliers is not proper under certain circumstances. ASPR Section 9-202.1(b) states:

"(b) *Contractors' Interest in Technical Data.* Commercial organizations have a valid economic interest in data pertaining to items, components, or processes which they have developed at their own expense. Such data is often closely held because its disclosure to competitors could jeopardize the competitive advantage it was developed to provide. Public disclosure of such technical data can cause serious economic hardship to the originating company." (Emphasis in original.)

Thus, it is Department of Defense policy:

"(ii) to provide an incentive to industry creativity by honoring the rights in data resulting from private development. . . ." ASPR § 1-304.1.

ASPR recognizes that it is important that efforts directed toward increasing competition do not demand or use privately developed data in a manner which is contrary to the policies and procedures concerning the Government's acquisition and use of technical data. *Ibid.* The Government must engage in a balancing of interests. ASPR § 9-202.1(c). ASPR states:

"[I]n balancing the Government's requirements for technical data against the contractor's interest in protecting his data, it should be recognized that there may be a considerable identity of interest. This is particularly true in the case of innovative contractors who can best be encouraged to develop at private expense items of military usefulness where their rights in such items are scrupulously protected. It is equally important that the Government foster successful contractual relationships and encourage a ready flow of data essential to Government needs by confining its acquisitions of technical data to cases of actual

Digitized by Google

need. . . . (C)ontrol [of the extent and nature of data procurement] is . . . necessary to insure Government respect for its contractors' economic interest in technical data relating to their privately developed items." ASPR § 9–202.1(c).

A proper application of these considerations in balancing the interest of the Air Force and that of the developer of the Enforcer does not warrant use of the Enforcer technical data in an industry-wide competitive procurement. The developer's rights must be protected if this type of development is to be furthered and encouraged.

When the Government desires to purchase privately developed items, but it is not appropriate to use technical data relating to the item in a specification for competitive procurement, the agency may use a sole source procurement. ASPR specifically provides:

"(2) When items of design or composition similar or identical to a privately developed item are required and it is determined that competitive procurement is not practicable, procurement should be on a noncompetitive basis from the firm which developed or designed the item or process or its licensees, provided productive capacity and quality are adequate and price is fair and reasonable." ASPR § 1–304.2(b)(2).

Under the circumstances of the development of the Enforcer, which has involved private development at private expense, the contractor's interest in protecting its rights in nondisclosure of technical data should be paramount. Only in this manner can we continue to obtain such developments from innovative contractors. The Air Force may and should under these circumstances procure additional Enforcers for flight test on a sole source basis.

Sincerely yours,

LOREN K. OLSON,
Counsel for Mr. David Lindsay.

Senator GOLDWATER. And I have only one other question that I wanted to get from Colonel Munelli. You started to testify, and you used the wrong words that upset Senator Thurmond. It did not upset me, because I did not understand it.

Do you know the Army's position on the Enforcer?

Colonel MUNELLI. Yes.

The Army supports the Air Force in their decision between these two aircraft. I am not prepared to give the Army's opinion on the test. However, the Army is supportive of the Air Force.

Additionally we would like to acknowledge the difference in the cannons as you have acknowledged it. As you know, we are putting the Americanized rounds on our helicopter, and we do acknowledge that it is less effective than they GAU–8 as we pointed out.

Senator GOLDWATER. Thank you.

I have to go, but we will let these two gentlemen conduct it.

Mr. Helms, I want to congratulate you on making one hell of a good airplane. I have flown in your crop dusters, and as fine as they are I made up my mind I didn't want to be a crop duster.

Mr. HELMS. That was a wise decision, Senator.

Senator GOLDWATER. I want to thank all of you for your appearance here today, and the presentations you made to this hearing, Mr. Helms, and Mr. Lindsay, and General Slay, and other members of the Air Force.

Mr. OLD. With the concurrence of the chairman he suggested a 5-minute break, and we will return.

[Brief recess taken.]

Mr. OLD. Mr. Helms, on one of your charts indicating an A–10 SAR cost and comparative Enforcer cost you said the A–10 is currently at $6.3 million. I believe that was the program unit cost, and you said the Enforcer has grown from $1.94 to $2.23 million as a projected pro-

Digitized by Google

gram unit cost. The question arises about that in order for you to get to that estimate you must have made certain assumptions that there would be absolutely no change taking place in the aircraft during its development prior to its coming into the inventory.

Is that correct?

Mr. HELMS. No. It is not.

First, the $1.49 million was not a Piper estimate, that was an Air Force estimate made in July, I believe of 1975, and what we did was to apply the inflation factor so it would be an apples to apples comparison with the A-10 data which I got out of the February 28, I believe, Aviation Week summary. So that was the source of the data.

To assume there were no changes—if you recall at the R. & D. Subcommittee hearing, we broke out in detail the fact that we had in fact factual cost estimates. Some of the testimony there brought out the Air Force made an assumption—as I recall it was $38,000 on armor.

Mr. OLD. The only point I want to make at this time is, do you accept the $2.23 million program unit cost? Is that a valid figure that the committee should accept?

Mr. HELMS. No, it is not. I do not agree with the Air Force's estimate. It is far too high.

Mr. OLD. I would like to go to Conclusion No. 5 of your statement which is,

> The U.S. Air Force falsely or erroneously advised the Senate Armed Services Committee of a mission profile capability of the A-10 compared to the Enforcer again creating an erroneous conclusion as to mission effectiveness.

Would you go over that, please. Is that based on any data that the staff of this committee provided you with?

Mr. HELMS. Yes.

If we could have Chart No. 20. If you look on Chart——

Mr. OLD. This was the chart that had the colored portion at the bottom.

Mr. HELMS. That is right. The portion that is unshaded and undashed is in fact the exact chart presented by the Air Force in the July 29-30 hearings of 1975. The top part heading was removed when we reproduced it in an effort to make sure we were specifically identifying the internal fuel at the bottom.

The chart then showed the A-10 could carry six Mark 82's, some 3,000 pounds, approximately 600 miles, or a little more. And brought it down to 22 Mark 82's, or 11,000 pounds of bombs, about 400 miles.

In response to our request—a definition of forward area is not involved in this chart here except to the extent that it identifies our use of the 4,228 pounds of fuel at the bottom, and four Mark 82's. The four Mark 82's which is the lower of the two lines: that was in response to our question of the capability of the airplane when operating from forward fields and to identify what the forward field was. The response was that it would take 3,000, I believe—I will check it—3,000 feet of runway, and in that condition, the airplane could carry four Mark 82's, or 2,000 pounds of bombs, and 4,280 pounds of internal fuel, or less than half, and with that load the mission profile would go forward 50 miles and rearward 150, which means an average of 100 miles. Therefore, that first dashed line is plotted in at the 100-mile radius line and goes across then to show the comparison of what the airplane can

Digitized by Google

[redacted]

[redacted] procurement] is ... economic interest it ASPR § 9-202.1(c). [redacted] the interest of the warrant use of the [redacted] procurement. The de- is to be furthered

[redacted] developed items, but it is [redacted] a specification for [redacted] use a sole source procurement. ASPR

[redacted] is identical to a privately [redacted] a competitive procurement [redacted] a competitive basis from the [redacted] its licensees, provided [redacted] that price is fair and reasonable.

[redacted] the Enforcer, which has in- [redacted] interest in pro- [redacted] should be paramount. Only [redacted] circumstances procure

Lieut. Col. Olson.

[redacted] for Mr. David Lindsay.

[redacted] other question that I [redacted] to testify, and you [redacted] discussed. It did not upset [redacted] the Enforcer?

[redacted] decision between these [redacted] the Army's opinion on the test. [redacted] the Air Force.

[redacted] the difference in the can- [redacted] we are putting the [redacted] as you know, we are putting the [redacted] and we do acknowledge that it [redacted] as we pointed out.

[redacted] gentlemen conduct it.

[redacted] on making one hell of a [redacted] dusters, and as fine as they [redacted] be a crop duster.

[redacted] Senator.

[redacted] of you for your appearance [redacted] to this hearing. Mr. Helms, [redacted] and other members of the Air [redacted] suggested a 5-

[redacted] of the chairman he

[redacted] your charts indicating an A-10 SAR currently [redacted] cost you said the A-10 is currently [redacted] that was the program unit cost, and you said [redacted] from $1.44 to $2.23 million as a projected pro-

Digitized by Google

n unit cost. The question arises about that in order for you to get hat estimate you must have made certain assumptions that there ld be absolutely no change taking place in the aircraft during its elopment prior to its coming into the inventory.
s that correct?
Mr. HELMS. No. It is not.
First, the $1.49 million was not a Piper estimate, that was an Air rce estimate made in July, I believe of 1975, and what we did was apply the inflation factor so it would be an apples to apples comrison with the A-10 data which I got out of the February 28, I beve, Aviation Week summary. So that was the source of the data. To assume there were no change—if you recall at the R. & D. Submmittee hearing, we broke out in detail the fact that we had in ct factual cost estimates. Some of the testimony there brought out e Air Force made an assumption—as I recall it was $35,000 on armor.
Mr. OLD. The only point I want to make at this time is, do you accept .e $2.23 million program unit cost? Is that a valid figure that the mmittee should accept?
Mr. HELMS. No, it is not. I do not agree with the Air Force's estiate. It is far too high.
Mr. OLD. I would like to go to Conclusion No. 5 of your statement hich is,

The U.S. Air Force falsely or erroneously advised the Senate Armed Services ommittee of a mission profile capability of the A-10 compared to the Enforcer gain creating an erroneous decision as to mission effectiveness.

Would you go over that, please. Is that based on any data that the taff of this committee provided you with?
Mr. HELMS. Yes.
If we could have Chart No. 20. If you look on Chart——
Mr. OLD. This was the chart that had the colored portion at the ottom.
Mr. HELMS. That is right. The portion that is unshaded and undashed is in fact the exact chart presented by the Air Force in the July 29-30 hearings of 1975. The top part heading was removed when we reproduced it in an effort to make sure we were specifically identifying the internal fuel at the bottom.
The chart then showed the A-10 could carry six Mark 82's, some 3,000 pounds, approximately 600 miles, or a little more. And brought it down to 22 Mark 82's, or 11,000 pounds of bombs, about 400 miles.
In response to our request—a definition of forward area is not involved in this chart here except to the extent that it identifies our use of the 4,228 pounds of fuel at the bottom, and four Mark 82's. The four Mark 82's which is the lower of the two lines: that was in response to our question of the capability of the airplane when operating from forward fields and to identify what the forward field was. The response was that it would take 3,000, I believe—I will check it—3,000 feet of runway, and in that condition, the airplane could carry four Mark 82's, or 2,000 pounds of bombs, and 4,280 pounds of internal fuel, or less than half, and with that load the mission profile would go forward 50 miles and rearward 150, which means an average of 100 miles. Therefore, that first dashed line is plotted in at the 100-mile radius line and goes across then to show the comparison of what the airplane can

Digitized by Google

do now as compared to what the Air Force told the Senate it could do some 17 months ago.

Our next question then was with a full internal fuel load, what can the airplane do? And the response came back, "It can carry 8 Mark 82's, or 4,000 pounds, to a radius of 264 miles."

Now the center chart, or center line shows the heavy dashed line at approximately 264 miles, as close as we could put it. That comes across then to the line of the eight Mark 82's, or 4,000 pounds. At that point then it is carrying slightly more in weight than the Enforcer, but at somewhat less distance. And in either of those two cases then—and our question was does it give us the maximum—therefore in neither of those cases can the A–10 carry any external fuel.

The chart on the right was presented by the Air Force as showing what the A–10 could do carrying external fuel 17 months ago, but using this data today from actual test results it would show the A–10 cannot carry external fuel and make these mission profiles as outlined here. That is what that chart reflects.

So we utilized the data furnished to us by the staff of this committee.

Mr. OLD. I know you are familiar with the A–10 brochure published by Fairchild.

Mr. HELMS. No, sir, I have never seen it.

Mr. OLD. Mr. Lindsay has a copy of it. I also provided Mr. Lindsay some Xeroxes of these mission profiles. I don't see anything contrary to what is on here that is not in the profile.

I accept your explanation on the Air Force until the chairman has an opportunity to respond to that, but I still don't fully understand it.

Mr. HELMS. Have I incorrectly promoted the information furnished to us by the staff?

Mr. OLD. The answer is I don't know. It is a little too heavy, and I don't think I can make the judgment at this point.

General BOND. I think someplace in the mission data, the profiles we have are for 18 500-pound bombs as opposed to 8. That is being discussed and at 18 500-pound bombs then the aircraft weight is such that we do not put external fuel on the airplane. I am not sure of any configuration where we carry——

Mr. OLD. I am the staff person that got involved in this, so we might as well get it straight now. The question that was asked was, "With full ordnance load how much fuel can the A–10 carry, or what is combat radius and loiter time?" Assume NATO standard today. The answer, which may be incorrect, came back, "The fuel at 10,659 pounds full internal ordnance was 8 Mark 82's, 1,350 rounds of 30-millimeter, takeoff distance approximately 4,000 feet, combat radius 264 nautical miles, and loiter time 5,000 feet at 1 hour."

Mr. HELMS. That is the data we used.

Mr. OLD. General Bond indicated maybe it should have been 18 rather than 8.

General BOND. I don't understand the correlation of weight. We will clarify that for the record.

General SLAY. The figures I have in front of me—and General Brill can correct me—the internal fuel and 6 Mark 82's, the A–10 can go

Digitized by Google

out 250 miles and loiter 3 hours and/or it can go out 670 miles and deliver its ordnance—

Mr. HELMS. That is with no loiter?

General SLAY. With 3 hours loiter it can go 250.

Mr. Old, I would suggest we have not had the opportunity to review the charges of misrepresentations that have been made, so we would like the opportunity to look at them and insert our comments in the record.

[The information follows:]

General BRILL. We have attempted to correlate Mr. Helms figures on weight and performance but without success. Therefore we will restate the test-verified A-10 design capability that is reported to Congress in the A-10 SAR.

The A-10 internal fuel capacity was sized to provide the A-10 with a two hour loiter at a mission radius of 250 nautical miles while carrying 18 MK-82's and 750 rounds of 30 millimeter ammunition. This internal fuel capacity then results in the radius/ordnance trade (with 30 minute loiter) that was shown by the Air Force.

The forward airstrip mission weight was devised to establish the A-10 off-runway surface hardness requirements and minimum runway length. The payload for this design mission consists of four MK-82's, 750 rounds of 30 millimeter ammunition and sufficient fuel to fly out 50 miles, loiter for 30 minutes and return 150 miles with a 20 minute fuel reserve. At the aircraft weight with this payload the A-10 can make 20 passes, a pass is a takeoff or landing, on the same strip at a CBR (California Bearing Ratio) of four. As the amount of fuel and external ordnance is increased either a field with a higher CBR is required or the aircraft will make fewer passes at a given CBR. The best analytical projection is that the A-10 can operate at maximum gross weight from a field having a CBR of six.

Mr. OLD. All right.

(Committee Note:)

With reference to the above discussion, it was subsequently determined that the staff had transposed the answers to two questions asked of the Air Force at the request of Mr. Lindsay and Mr. Helms.

Consequently, this caused some of the data on chart 20 to be in error and also the misunderstandings during the hearing. Mr. Lindsay and Mr. Helms were informed of this error and given an opportunity to revise their prepared statements based on the correct answers to their questions. The committee regrets this inadvertent error.

Mr. Lindsay, are you familiar with the provisions of OMB circular A-109 giving guidance and direction on the procedure for weapons acquisition?

Mr. LINDSAY. I have read that. I believe in Senator Child's committee—and I was sent a copy of their analysis of the CH-53-H Helicopter—I have not received anything this year concerning the A-10—I have the comparable analysis for the A-10 for February 15, 1976. But I am familiar with the desire to have flight before purchase and more competition.

Mr. OLD. Assuming the A-10 is bought, that the program is reasonably well established, production is occurring, aircraft are coming into the inventory, and your aircraft at this particular point in time would be a new system, do you believe that the provisions of this new acquisition process would apply to the Enforcer?

Mr. LINDSAY. I am not enough of a lawyer to answer that. Mr. Loren K. Olson, who was just here, I believe has left, was prepared to speak to that subject.

Digitized by Google

Mr. OLD. Mr. Olson's comments were on the ASPR's. I believe the ASPR's have been supplemented and are superseded by this.

Mr. LINDSAY. The question would be whether we might come in under the grandfather clause, because I know of no one, working as many years as I on this subject—and I feel I have met the ASPR requirements of contributing something of value to the country—therefore I strongly feel it would be most unfair to now throw this out to competition after we have displayed over and over again all our secrets, after we made our patents available even on the mounting of 106-millimeter cannon to everyone without charge. It seems to me we have earned a test of that airplane.

Mr. OLD. May I suggest, Mr. Olson, in submitting the document that the chairman approved, also expand, if he wishes, his interpretation of this OMB circular.

Do you feel the U.S. Government then should exclusively test your aircraft when others might have an aircraft that wasn't tested?

Mr. LINDSAY. No one else has one in being that has actually flown these missions. We were the only aircraft which successfully flew the Pave Coin test which the Air Force sometimes calls a test and sometimes calls an evaluation. We were the clear and absolute winner of Pave Coin.

Mr. OLD. If an interpretation was made that the Department of Defense must follow the provisions of the new OMB circular re weapons acquisition, then they could well be forced into the position of having to conduct an industry-wide competition if they determine such a competition was needed.

Mr. LINDSAY. I have enough confidence in the flexibility of the American Government in times of emergency, as ilustrated by the report by Senator Nunn and Senator Bartlett on "NATO and the new Soviet threat," that they would find a way to utilize a weapon which is apparently the only one the Air Force says is immedately ready to go into production.

The changes which are contemplated are rather minor. I know of no other airplane, not only in the United States but in the world, which is in that situation. Most of them concentrate on light, small twin jets with a compatibility of trainer use as well. We think we have something absolutely unique. We have made a total disclosure of it as required by the Patent Office. It contains a number of original patents, and we think we have earned a test of this aircraft, yes.

Certainly I feel as Senator Goldwater does, that other people in the future should be encouraged to come along and bring up their ideas, but I know I have brought up mine, and with the help of a great many people. The gentleman who flew over on the Concorde-Mr. Baker—his company has been working with me since I first took Mr. Alan Thompson, of that company, down to see General Momyer at TAC headquarters in the late 1960's, and they made the statement ours is the only project they feel is feasible and logical enough for them to spend their own money on.

I think when you have a case of Piper going this far, I think we are entitled to some treatment other than a speculator who comes along and now wants to jump on the bandwagon.

Mr. OLD. I would like to interject that if my questions sound unfriendly——

Digitized by Google

Mr. LINDSAY. I didn't mean to imply that.

Mr. OLD [continuing]. They are not intended to be that way, but these are matters that will be considered by the committee, and we should have them on record.

Mr. HELMS. I think the record should be expanded to include that the history of aircraft development in the United States has clearly established when it is necessary to do so there are methods within the Government to select and acquire an aircraft without always responding to every element of it, and I am sure you know what I am referring to.

Mr. OLD. Yes, sir.

In the interest of time, you may add a supplement to the record here if you wish, but I want to go through a few questions.

Will you describe the operational test you want the Government to make with the Enforcer, and do you have a test profile in mind?

Mr. LINDSAY. Mr. Helms is the one who made a study of that and is best qualified to respond.

Mr. HELMS. After initially completing those tests which would be required to certify safety so we could get military pilots in the normal things that any test pilot does, we would start a series of tests for various ordnance loading, mission profiles, radius of action, to confirm that four aircraft flying together are not dependent on one set of data. This would be a short phase.

We would then take the four aircraft and move them about from possibly Fort Hood, Tex. to Fort Bragg, N.C., to Cherry Point, N.C., to wherever the Air Force wanted to use it, and have a multiservice usage of the airplane with emphasis in the field with overlapping service personnel from one military service to the other. This program would take about 4½ or 5 months. And any of the services that wanted to could keep it longer.

The final portion of the test program we believe should include the use of two aircraft for targets to test the weapons which we have been talking about at the White Sands range. Let's find out if the armor is as good as we say it is. We believe the airplane should be drones and used for testing the forward area ground ordnance. The two remaining aircraft we think could be positively used by respective test centers as regards training of test pilots because we should retain within our capability the pilots to test the propeller driven airplanes.

Mr. OLD. What in your mind would it cost for successful operational test?

Mr. HELMS. Success would be defined one of two ways. First, it just won't work, and this is why some input considerations——

Mr. OLD. It may not be a matter of it just won't work, and this is why. It may be a matter of it works but not as well as other systems.

Mr. HELMS. That is right, but I had not gotten to the portion of my answer, Mr. Old. I was trying to be objective to point out from the Nation's view that it is just as valuable for us to know that it won't work and why, as it is we know it will work and why, and variations thereto. So that the success of the program could be measured by the fact for the first time we do have operational test data and we know that what may appear to be simple in the terms of subsystems when

Digitized by Google

we get into the field they won't work and we know why. Or we know we can put them in the field and they work even better than we hoped. That you can use World War II type airframe design and change the engine, and those type data would come out of it in future considerations then because I personally am concerned about the unit cost increases of our air weapons.

As some point in time the Air Force will have to sit down and write a spec for another machine and it would be extremely valuable to them to have these test results in their data bank as a jumping off point from which to start.

Mr. OLD. Thank you.

General Slay as the Deputy Chief of Staff for Research and Development, do you have the authority to order an operation test of the Enforcer?

General SLAY. No, sir, I don't.

Mr. OLD. If not, who has the authority?

General SLAY. The Chief of Staff would have that authority.

Mr. OLD. General Slay, is it possible that with the Enforcer the Air Force is suffering from a "not invented here" syndrome?

General SLAY. I would like to think not, Mr. Old.

Mr. OLD. Have we created in our Government bureaucracy a barrier that precludes private citizens with good ideas from not being able to get them adopted?

General SLAY. I fervently hope not, Mr. Old. I certainly have to agree with what the chairman stated earlier, that that is something that we want to encourage.

AIRCRAFT PROCUREMENT PROCESS

Mr. OLD. For the record, please, will you describe the process that the Air Force follows in bringing a new aircraft in the inventory. Explain how a ROC, DSARC, JSOP, FYDP force structure and the congressional funding process all interface.

General SLAY. I will go through it step by step.

[The information follows:]

The process you refer to, however, is very complex and detailed and actually involves three parallel but closely related processes. I'll try to summarize these, showing the various interfaces and pointing out the particular elements you referred to.

The first process is the major system acquisition process. We are implementing the provisions of OMB Circular A-109 and DOD directives 5000.1 and 5000.2, so our administration of this process may change somewhat. The first step in the acquisition process is the identification of a mission need. The need itself is defined and documented through mission analyses, considering the assigned mission task, present capabilities, the threat, the operational environment, tactics, resources, and other constraints.

One of the documents used to express a need is the Required Operational Capability, or ROC. The ROC is the formal document by which field commanders, or users, identify an operational need and request a new or improved operational capability to meet that need.

In the case of a major system acquisition, a higher headquarters broad assessment of a mission need, along with supporting analyses, is submitted to the Secretary of Defense for approval. His decision—Milestone 0—approves the need and direct us to begin exploring alternative concepts to satisfy this need.

Approval by the Secretary of Defense is required at three other decision points, Milestone I—Demonstration and Validation, Milestone II—Full Scale Engineering Development, and Milestone III—Production and Deployment. Each of these decision points is supported by documenting the program in a Decision Coordi-

Digitized by Google

nating Paper (DCP), and through review of the program by the Air Force Systems Acquisition Review Council (AFSARC) and the Defense System Acquisition Review Council (DSARC). The AFSARC and DSARC are the senior advisory bodies in the Air Force and OSD, respectively, on systems acquisition. The Secretary of Defense makes his milestone decision based upon the DCP and the recommendations of the AFSARC/DSARC. (The AFSARC is convened for all Air Force milestone reviews; the use of the DSARC is at the option of the Secretary of Defense.) The decision is strictly a program decision, not a force structure or a financial decision. The Secretary of Defense reaffirms the mission need and determines that the program is ready to enter the next stage of development.

The second process involved in bringing a new aircraft into the inventory is the Joint Strategic Planning System (JSPS). The JSPS is the primary vehicle used by the Joint Chiefs of Staff (JCS) to provide military advice to the President and the Secretary of Defense, as well as strategic direction to the Services. Included in this system is the Joint Staff's estimate of the threat against the United States, the JIEP, or Joint Intelligence Estimate for Planning. The Joint Strategic Capabilities Plan, or JSCP, provides the Services with the specific operational tasks for which operational plans are required. The Joint Strategic Objectives Plan, or JSOP, contains the military strategy required to attain U.S. national security objectives. The JSOP also provides overall force planning guidance to the Services. A second volume of the JSOP is issued by the JCS approximately six months after Vol I. JSOP Vol II tabulates the forces required to execute the U.S. military strategy. The remaining JSPS documents deal with long range planning. This area of planning is generally used to surface future capabilities and broad features of the future force structure rather than the number of end items as in the case of short- and mid-range planning.

Most of the elements which were cited in your questions are in the two processes I've just summarized, the major system acquisition process and the Joint Strategic Planning System. I said, however, that there were three processes involved. The final one is the Planning, Programing and Budgeting System (PPBS). Most of the interfaces concerned with bringing a new aircraft into the inventory occur through, or as a part of, the PPBS.

The publishing of the JSOP, Volume I, by the JCS officially initiates the planning portion of the PPBS. The Secretary of Defense examines the JSOP and then issues his Defense Policy Guidance (DG). The DG outlines the President's national security policies, and amplifies or updates the JSOP Volume I guidance as appropriate. Following JCS publication of JSOP Volume II, the Secretary of Defense issues his Planning and Programing Guidance, the PPG. This formally initiates the programing portion of the PPBS. The PPG contains sufficient force planning guidance, fiscal guidance, and material support planning guidance for the Services to fully develop their programed forces. The resulting forces are submitted to the Secretary of Defense as the recommended force structure. These recommended forces are tabulated in the Program Objective Memorandum, or POM, for each Service, and jointly through the JCS in the Joint Force Memorandum, or JFM. Following review of the POM and JFM, there is a structured means for OSD to take issue with various aspects of the proposed program. This is done through the Secretary of Defense decision on the issues and alternatives as published in the Program Decision Memoranda, or PDMs. After a reclama period, Amended Program Decision Memoranda (APDM) are issued and we officially enter the budgeting portion of the PPBS.

The POM, as amended by the APDM, is then priced out and submitted to OSD as the Air Force budget estimate for that year. (The budget and projections for the next four fiscal years are tracked within DOD using a line by line bookkeeping system called the Five Year Defense Program or FYDP. The FYDP is continually updated to reflect the latest approved figures as these changes occur throughout the PPBS.) Following joint OSD and Office of Management and Budget (OMB) hearings on the budget estimate, OSD publishes the Program Budget Decisions, or PBDs. Again there is a period for reclama actions. Following the revised PBDs, the resulting Service programs are incorporated into the overall defense program, and finally transmitted to OMB where they become part of the annual President's Budget.

If all this appears to be very cumbersome and confusing with all the jargon and fancy acronyms, I apologize for that. I wish I could simplify things for you, but I can't. The process is complex. It is filled with checks and balances. Most important, it is a process which does not permit the Air Force, or any other organizational element, to unilaterally bring a new major system into the inventory.

Digitized by Google

The process is truly a corporate one, extending to the Congress and to the President. The authorization hearings before you today as well as those in the House, and the separate appropriation hearings before the Senate and the House are also part of the final approval process for development and production of a new aircraft system. In spite of the intricacies of this total corporate process, I must also add that it is a process which has served us well.

Mr. OLD. Is it possible that the Air Force in creating its force structure and having ongoing programs and budget limitations can get itself in a position where if it really wanted an aircraft right today, wanted to change everything, that would be a difficult thing to do?

General SLAY. It is not only possible, it is facing us daily.

That is a difficult thing to do. We are limited on the number of people that we can have in the Air Force. We are limited on the number of combat wings that we can have in the Air Force. And we are limited by dollars on how much we can buy of the various systems that we have on our flight line now. So your comment is apt and true.

Mr. OLD. Thank you.

Mr. Lindsay told the R. & D. Subcommittee in 1975 he thought there were basically two reasons why the Defense Department did not want the Enforcer. One, the Air Force did not want any more airplanes with propellers, and two, Air Force people were somewhat defensive of existing systems and that people did not like unique things which the Enforcer was. I am paraphrasing from page 74 of those particular hearings.

Do you care to comment on that?

General SLAY. Of course I don't agree with them.

AIR FORCE GIVEN DATA BY MR. LINDSAY

Mr. OLD. Has the Air Force ever contacted Mr. Lindsay for data on which to base cost figures for the Enforcer?

General SLAY. General Stewart and Mr. Rall went to some length to get all the data that was available. Perhaps Mr. Rall could answer that.

Mr. RALL. Yes, sir; as a matter of fact, Mr. Lindsay was very helpful in obtaining information for us to provide for our evaluation purpose and at the conclusion of our evaluation which I think dates back to the latter part of 1974 we debriefed Mr. Lindsay as to what our results were, and my recollection of that meeting is he had no major objections.

Mr. LINDSAY. Mr. Rall, I agree with the statement with this exception. I don't believe that we made any attempt to cross-reference our cost estimates. I did supply you certain quotes from engine manufacturer and from the heads-up display manufacturer, but I don't think there was a debriefing session on production quotes. There certainly was on performance, and we had a great deal of help from Mr. Rall's engineers.

Mr. OLD. The purpose of the question is again to try to ferret out where these cost differences come from that Mr. Helms said he does not agree with.

Mr. LINDSAY. I am not an accountant, and I am not as experienced as Mr. Helms, but it is my observation where we begin to fall apart on costs is where we go from flyaway costs to program costs, to life cycle costs. Life cycle to me makes me feel I have entered the window or the

Digitized by Google

mirror in Alice In Wonderland. I think it is possible to ascribe whatever you want to squadron operations cost, pensions of pilots widows, and that sort of thing. I do think we can pin down quite accurately operational costs, man-hour per flight-hour, and that sort of thing, but life cycle cost goes far beyond that.

I might point out in this area I think all of us are worried that the life cycle in combat of a close support aircraft of anyone's design may be much more limited than we would like.

Mr. RALL. I would add to what Mr. Lindsay said about the difference in the cost. One of the things which I think was apparent again today is the difference between the cost quoted by Mr. Lindsay or Mr. Helms is the cost as reflected by the contractors. The Air Force cost estimates—even restricted to flying cost—include these costs to the taxpayers of GFE equipment which would be required to make the Enforcer a live aircraft.

Mr. OLD. Cost was never an issue as far as the Air Force concern. Is that correct?

Mr. RALL. That has never been an issue. In the testimony we had last July, 1975 and again what Mr. Helms has shown today, if we put it on an apples to apples basis including the GFE cost, which is the cost to the taxpayer, we are not very far apart, and I think the number which General Stewart showed about a year and a half ago showed a difference of about 6.5 percent, and I think that is probably a fairly accurate representation. I think Mr. Helms would agree with that.

Mr. HELMS. I would agree, and I think I could go further and show you why those differences exist. The difference was actually 8.4 percent which was accurate in that time period, but I will reduce it to two things. The Air Force estimated $129.9 million for development program with factor of inflation escalation. To take it to the larger figures, if we use their figure of $129.9 million our corresponding figure in 1975 was $67 million. If you take that difference and amortize it you now have a difference of $185,000 in unit flyaway, and that is true in these numbers you are looking at here.

The other major item is, as I recall the testimony—and I am confident I am right—the R. & D. subcommittee hearings showed the Air Force used a 70-percent maintenance factor. That is, they applied 70 percent to the maintenance hour per flight hour to the Enforcer they had for the A–10. We disagree with that. We believe the maintenance hour per flight hour for the Enforcer will be lower and using an example of that historical data that existed from the Navy on the A–4, less than 7 hours, the Air Force's F–100's, got down below the present A–10. And looking at the data we now have, we believe for the Enforcer it is in the order of 3 to 4 hours or less.

If we apply that direct back to the cost factors which we are using on A–10, our data shows it would be less than 40 percent rather than 70 percent. In general I agree with Mr. Rall. Cost has not been a major item between us, but that accounts for differences, but in this particular one it showed up large because of that inflation factor that was applied. He was right if you add GFE you are talking about $199,000 unit price difference.

General BOND. One of the things supportive of Mr. Helms but a different look at the rationale, we developed our support costs and our

Digitized by Google

support factors. We found they are driven heavily by the sophistication of avionics in the aircraft.

I think one of the things that influences the Air Force evaluation of the Enforcer is that as we add things like displays, things necessary to provide Maverick capability, other new capabilities to their airplane, that the connotation one gets from the picture of the airplane changes very dramatically as far as support costs and support manhours are concerned.

Mr. OLD. Mr. Helms, in your fuel comparison operating fleet of 500-plus A–10's in Europe——

Mr. HELMS. I used 504, which equates to seven wings of 72 aircraft each.

Mr. OLD. Irrespective of where the aircraft are they used 504 airplanes. You did not put in that analysis how many tank cars of fuel that would be required on a daily basis to operate close air support missions in Europe.

Mr. HELMS. I know of no other way to do it. If the Air Force says they will use 504 aircraft to destroy the targets I must use their data.

Mr. OLD. The Air Force has requirements to have forces prepared to meet other contingencies, and the possibility does exist not all the A–10 assets would in fact be in Europe.

Mr. HELMS. I accept that, but General Stewart said they selected that scenario and out of that came the 504 aircraft. Irrespective of the distribution it still is going to take that much fuel to operate the A–10's compared to the Enforcer.

Mr. OLD. Assuming your figures are correct, I suspect we are going to need considerably more fuel for F–15's and F–16's.

Mr. HELMS. On a mission-for-mission basis you will need a lot more. When you go into afterburner you will use a lot of fuel.

Mr. OLD. I want to point out a problem of logistics in operating in NATO. That is a situation that is going to be very difficult so it isn't necessarily unique to the A–10.

Mr. HELMS. I agree.

Mr. OLD. I have a number of questions for the record, Mr. Lindsay. I will appreciate your answering on behalf of the chairman. Also for the Air Force, and thank you very much.

I think Mr. Cromwell has a few questions.

NAVY EVALUATION OF ENFORCER

Mr. CROMWELL. General Bond, the statement was made the Air Force did not accept the Navy and Marine Corps' study of the Enforcer. This possibly could be construed as implying the Navy and Marines had endorsed the Enforcer. Is it correct that the Navy and Marine Corps also rejected the airplane after their studies?

General BOND. That is essentially correct. I am not familiar in detail with their study. I think the more accurate thing is because of continued pressures on the individual services that the Air Force—not because they did not accept the others but so that they would have their own yardsticks that we had used historically in evaluating new weapons systems—the Chief of Staff directed General Stewart to conduct an in-depth evaluation for the Air Force using Air Force factors

Digitized by Google

that we clearly understood how they applied, and that was the genesis of it.

Mr. CROMWELL. Would you contact the Department of the Navy and insert in the record at this point their position on the Enforcer that resulted from your studies?

General BOND. We will be pleased to.

[The information follows:]

The Naval Air Systems Command evaluated the Enforcer in 1973 for close air support missions. The 1974 Air Force Aeronautical Systems Division evaluation of the Enforcer reviewed the results of this study. In the moderate subsonic speed, turboprop-powered class, the Enforcer was compared with the OV–10A (USAF Bronco) and the V–433 (Ling-Temco-Vought Corp. design). Naval Air Systems Command's general conclusions regarding these aircraft were that turboprops provided a good cost/payload index and short field capability, and were attractive if the speeds were acceptable. Specific conclusions on aircraft within the turboprop area were as follows:

a. The Enforcer and OV–10A were closely competitive with the advantage of the higher performance in the Enforcer offset by the lower cost, twin engine reliability, two-place, and nose wheel type landing gear of the OV–10A.

b. the V–433 represented newer airplane technology with attendant increases in performance and a better cost/payload index than the Enforcer. A design competition would be the most practical way to select the best cost/effective turboprop design for CAS missions.

A current U.S. Navy position on the Enforcer aircraft is being obtained separately pursuant to Senator Goldwater's request and will be provided to the Committee Chairman.

Mr. CROMWELL. General Bond, Senator Thurmond went through a series of technical questions on radar cross section, high, signature vulnerable area, and so forth. Were all of those factors included in the Air Force analysis of the Enforcer?

General BOND. That is correct. They were.

NO NEW TECHNICAL INFORMATION PRESENTED

Mr. CROMWELL. Has any new technical information on the Enforcer been presented today that was not known to the Air Force in 1974 when it evaluated and rejected the Enforcer?

General BOND. Not of significance. I don't think in making a determination of the operational utility of the weapon system. There have been small changes to the potential configuration of the airplane, to enhance its capability were it inventoried, but there has been no change I am aware of that would change the end result of our evaluation.

QUESTIONS SUBMITTED BY SENATOR BARRY GOLDWATER

(Questions of Senator Goldwater for Mr. Lindsay and/or Mr. Helms, to be answered for the record are as follows: Enforcer Aircraft:)

Question. The A–10 operating from a 3000' hard surface can take off in about 1800' carrying 4 MK 82's, 750 rounds 30 MM ammunition, go 50 NM to a target, loiter for 30 minutes, then return 150 NM to its MOB with 20 minutes reserve fuel.

Can the Enforcer perform this same mission?

Answer. Of course the A–10 and the Enforcer were not designed to the same mission or performance specification: accordingly if one chose he could certainly find a specific mission capability available in one airplane that is not available in the other.

For the mission specified in this question, an Enforcer take-off weight of 14,357 pounds would be present, without the 30 MM gun capability. This would require

Digitized by Google

a take-off roll of approximately 1600 feet and provide a radius of approximately 296 miles. Adding two NATO standard ADEN-DEFA 30 MM gun pods, with 150 rounds each, thereby giving the Enforcer two 30 MM cannons and either six 50 caliber or two 20 MM cannons in the wing, a weight of 15,853 would result, increasing take-off roll to 1650 feet and decreasing mission radius to an estimated 265 miles. While this may be a mission effectiveness comparison, we must note that the Enformer with two 30 MM cannons and two 20 MM cannons, (a total of four available compared to the A-10 with one cannon) has a cost effectiveness even more important. As regards cost, the USAF has acknowledged approximately three to one. And we believe it is closer to five to one. Using four to one, for the same money to put an A-10 firing one 30 MM gun at tanks, the Enforcer could supply four simultaneous attacks on four targets with eight 30 MM cannons and eight 20 MM cannons, or sixteen total. The cost effectiveness is dramatically in favor of the Enforcer.

Question. The A-10 with 6 MK 82 500 pound bombs can maintain 2.29 sustained G's at 150 knots and 3.26 sustained G's at 275 knots.

Can the Enforcer match that performance?

Answer. As was noted earlier, the aircraft were not designed to the same specifications. The Enforcer cannot carry 6 MK-82 500 pound bombs and maintain 2.29 sustained G's at 150 knots and 3.26 sustained G's at 275 knots. Interpolation of data plot indicates values for the Enforcer of 1.4 G's and 2.3 G's respectively. We request for the record that a copy of the USAF flight test validating claimed A-10 capability be included in the record.

Question. The A-10, with full fuel load, carrying 8 MK 82's, 1350 rounds of 30 MM ammo and using 4000' of runway has a combat radius of 264 NM and a loiter time of one hour. Can the Enforcer perform that same mission?

Answer. The Enforcer can carry four MK-82 bombs with two 30 cannons to a radius of 272 miles and loiter for one hour. This will require a take-off roll of approximately 2100 feet. For the same cost as one A-10, four Enforcers can therefore carry 16 MK-82 bombs, 2.66 times that of the A-10, for a longer radius at approximately one half the ground roll, with eight 30 MM. cannons and 1200 30 MM. rounds.

The maximum capability of an aircraft is explored during a "surge" test, whereby the maximum number of sorties with the maximum ordnance expended is undertaken in a given period.

Recent USAF press releases showed the A-10 surge capability as 4 MK-82 bombs dropped per sortie and 109 rounds of 30 MM. ammunitions fired per sortie as a result of field tests conducted. Those tests were from a hard surfaced runway and concrete ramp airfield in the sunshine of Gila Bend, Arizona. For the same number of sorties, each Enforcer could have dropped 6 MK-82 bombs and fired many times that amount of 20 MM. ammunition, or dropped four MK-82 bombs and fired 300 rounds of 30 MM. anti-tank ammunition from two Aden-Defa guns.

For the same unit airplane cost of one A-10, two Enforcers could have dropped twelve bombs as compared to the four of the A-10, and two more Enforcers could have fired 600 rounds of 30 MM. ammunition (two 30 MM. pods) plus hundreds of rounds of 20 MM. cannon ammunition (two 20 MM. cannons per plane). Four targets would have been attacked simultaneously in support of Army troops in combat. And in event one airplane was shot down only one-fourth the combat loss would have occurred.

Question. Could you give the Committee a definition for a forward field from which the Enforcer could operate?

Answer. Three thousand feet of unpaved open field or pasture with a California bearing ratio of four or more.

Question. Mr. Lindsay, I believe you have a copy of the A-10 performance characteristics taken from the Fairchild brochure. For the record will you enter the Enforcer performance parameters so that we may have a side by side comparison?

Answer. We do not believe it fair to ask us to compare actual flight test results, some flown by the USAF, with Fairchild A-10 sales brochure information. We will perform comparisons if desired with USAF flight test data from the A-10 furnished by the USAF.

Question. Still referring to the Fairchild brochure, three close support fire mission profiles are given:

No. 1. 6 MK 82 bombs, 750 rounds 30-MM, 10 minutes combat, 350 NM radius, and one hour loiter and 20 minute reserve. Can the Enforcer match that mission?

Digitized by Google

Answer. We do not believe it fair to ask us to compare actual flight test results, some flown by the USAF, with Fairchild A–10 sales brochure information. We will perform comparisons if desired with USAF flight test data from the A–10 furnished by the USAF.

No. 2. 6 MK 82 bombs, 750 rounds 30–MM, 10 minutes combat, 150–NM radius, and 3 hour loiter and 20 minutes reserve. Can the Enforcer match that mission?

Answer. We do not believe it fair to ask us to compare actual flight test results, some flown by the USAF, with Fairchild A–10 sales brochure information. We will perform comparisons if desired with USAF flight test data from the A–10 furnished by the USAF.

No. 3. 18 MK 82 bombs, 75 rounds 30-MM, 10 minutes combat, 250-NM radius, and 2 hour loiter and 20 minutes reserve. Can the Enforcer match that mission?

Answer. We do not believe it fair to ask us to compare actual flight test results, some flown by the USAF, with Fairchild A–10 sales brochure information. We will perform comparisons if desired with USAF flight test data from the A–10 furnished by the USAF.

Question. There is also a low altitude mission:

Eight MK 117 bombs (750 pounds each) (6000 pounds total), 750 rounds 30-MM, 5 minutes combat, 334–NM radius, and 20 minutes reserve. Can the Enforcer match that mission?

Answer. We do not believe it fair to ask us to compare actual flight test results, some flown by the USAF, with Fairchild A–10 sales brochure information. We will perform comparisons if desired with USAF flight test data from the A–10 furnished by the USAF.

Question. How does the Enforcer propose to kill tanks?

Answer. Exactly the same way as the A–10, using either bombs, missiles, or cannons. The A–10 30 MM. has seven barrels, but only one magazine/loader. It is therefore, restricted to the reliability of that one part. The Enforcer will carry two ADEN–DEFA 30 MM. cannons and, incidentally, can thereby re-arm from any NATO field force, and will use gasoline or diesel fuel and can, therefore, refuel from any NATO field force.

Once a missile is on its way, it doesn't care from whence it was launched. The tank-kill capability of missiles is precisely the same for the Enforcer as the A–10.

Question. What is the largest practical gun system that could be mounted?

Answer. A 30 MM. cannon (two) can be carried by the Enforcer. Tests conducted on the 106 MM. recoilless cannon fired from an aircraft with the same basic size and geometry as the Enforcer were highly successful, and at a peak of demonstrating the kill capability of this relatively cheap tank-kill mechanism when the tests were abruptly halted. We have sought but never been advised as why the very satisfactory tests were stopped in midstream.

Question. What are the demonstrated capabilities of the 106 MM recoilless gun?

Answer. Objectively, the accuracy of the Enforcer 30 MM. gun and the 106 MM. recoilless rifle would not be as high as that claimed for the GAU–8. Firing tests, however, confirm both appear quite satisfactory.

Question. Are you familiar with the armor technique used in the A–10 and the survivability claims made for the aircraft?

Answer. We are familiar with such information on the A–10 armor system as has been released by Fairchild Industries, to the aviation press by the USAF, and discussed in open congressional hearings. This includes the "Titanium bathtub" concept for the cockpit, and survivability claims such as the use of redundant hydraulic controls, reticulated foam in the fuel tanks, etc. Claims have also been made as to survivability advantages of two engines, even though these engines are not armored (as is the Enforcer's), and greatly increase vulnerability due to fuel transfer controls, foreign object damage, and possibility of fire from impact damage, etc.

Question. How does the Enforcer compare? Can it meet the same standards?

Answer. We believe the Enforcer team presentation has shown that the Enforcer's far greater percentage of armor per pound of aircraft weight, its armoring of more vital systems, and its far smaller target size make it not only meet but far exceed the A–10 in survivability.

Question. How do you answer the charge that the Enforcer is nothing more than a warmed over P–51 that uses 30 year old technology?

Answer. This question, which has been repeatedly used by opponents to attack the Enforcer, is fully addressed in pages 8 through 11 of the Lindsay prepared

Digitized by Google

testimony of March 16, and pages 3 through 5 of the Helms testimony of the same date, before the tactical aircraft subcommittee of the Senate Armed Service Committee.

The USAF analysis conducted by the top level of the aeronautical systems division at Wright-Patterson AFB credits the Enforcer with heads-up display, Maverick missile capability, advanced state-of-the art armor, unique,y simple yet flexible weapons control system, proven prop-jet propulsion, reticulated foam in fuel tanks, latest ejection seat, unusual broad-spectrum avionics, ECM (electrical countermeasures POD capability), and many more such features. This can hardly be called 30-year old technology.

Question. In your 1975 testimony you said you have never suggested that the Enforcer could or should replace the A–10.

Why should not the Enforcer "replace" the A–10 if it can do the same mission as well and for lower unit and life cycle costs?

Answer. Although it appears the status of production of the A–10 make it unrealistic to consider "replacing" the A–10 program, the announced failures of the A–10 to meet its program goals, and Gen. Jones statement in aviation week that the USAF has considered modifications to improve thrust and drag performance but "there do not appear to be low cost alternatives available", make it now logical to consider replacing a portion of the A–10 proposed buy with the more cost-effective Enforcers. The Lindsay testimony of 1975 was made without awareness of just how badly the A–10 was failing to meet close support requirements.

(Questions to be answered for the record by General Slay are as follows:)

Senator GOLDWATER. Why does Air Force believe the A–10 is the best close air support system it could develop?

General SLAY. The A–10's capabilities have been assessed by a series of operational tests. When judged against its basic mission, Close Air Support (CAS), the Air Force Test and Evaluation Center concluded the A–10 could perform the CAS mission better than any other aircraft in the present inventory. More specifically, the A–10 was primarily designed for an anti armor role in a European scenario. No other existing or proposed aircraft has the proven lethality or survivability in this role. The A–10 also has the capacity to accept and utilize relatively modest changes planned to enhance its overall capability. For example, the A–10 will employ the IIR and Laser Maverick when they become available.

Senator GOLDWATER. Why is the A–10 more survivable than the Enforcer? Mr. Helms told us in 1975 that the Enforcer was smaller in size, greater in armor and equal in speed, and I would guess it is at least as maneuverable. Why wouldn't the Enforcer be more survivable or do you agree that it is?

General SLAY. Even though the A–10 has significantly larger presented areas than does the Enforcer, the A–10's vulnerable areas to 23 mm anti-aircraft fire are only one tenth to one half those of the Enforcer. This is due primarily to the structural and subsystem redundancy, extensive use of titanium armor around vital areas, fire suppressant foam in voids in the aircraft, self-sealing fuel tanks, physical separation between vital components and the two-engine configuration. The extensive redundancy and physical protection measures mentioned above will allow the A–10 to survive a hit in what would otherwise be a critical area in an aircraft of lesser design.

Senator GOLDWATER. What is the Air Force interpretation of the OMB Circular A–109 as it relates to the acquisition of major systems?

General SLAY. In our interpretation, there are two principal new concepts in A–109.

First, the Circular requires any new major program to begin with a validated mission need, prior to seeking or identifying system solutions.

The second major concept is that of encouraging competitive exploration of all possible solutions to best meet the validated mission need.

We are now implementing these concepts as they are spelled out in Department of Defense Directives 5000.1 and 5000.2.

Senator GOLDWATER. Keeping in mind all the directives and laws Air Force must operate under, outline for the Committee how the Air Force would develop and procure an aircraft like the Enforcer if it wanted to do so.

General SLAY. I view the directives and laws under which we operate as part of a system of checks and balances that has evolved from lessons learned

Digitized by Google

over a period of many years. As you know, I provided you earlier a detailed discussion of how the Air Force brings a new system into the inventory. In that discussion, I pointed out that the system acquisition process begins with the establishment of an operational requirement and this is followed by a search for feasible solutions. In our study of these alternative solutions, we would consider the Enforcer, if applicable, and any other competitive system that appears to be cost-effective. Our directives and laws require that we be able to defend the final solution, and the system selected must stand the test of rigorous review prior to source selection approval.

What this all boils down to is that we simply cannot procure on the basis of whim. Our system choices are clearly documented every step of the way—to ensure fairness in our dealings with industry and at the same time ensure that what we buy satisfies the operational requirement.

Senator GOLDWATER. Keeping in mind all the directives and laws Air Force must operate under, outline for the Committee how the Air Force would develop and procure an aircraft like Enforcer if it wanted to do so. Provide for the record an opinion by the Air Force General Counsel on this matter.

General Counsel Opinion:

The following general outline of the process by which an aircraft like the Enforcer, a major weapon system, would be procured in accordance with pertinent procurement law, regulations and directives responds to the request of a member of the Senate Armed Services Committee (SAC) in its record of 16 March 1977. Of apparent concern to the requester is the role of competition in the process by which such an aircraft is developed and produced.

The Air Force is required by law to procure its needs on a competitive basis to the maximum extent practicable. See 10 U.S.C. 2304(a) and (g), as implemented by ASPR 1-300.1. This requirement is reflected in executive policy guidance, and departmental directives establishing policies and procedures to carry out such policy guidance. See OMB Circular A-109, "Major Systems Acquisition", Department of Defense Directives 5000.1, "Major Systems Acquisition", 5000.2, "Major Systems Acquisition Process" and 4105.62, "Selection of Contractual Sources for Major Defense Systems", respectively.

The following outline, setting forth the principal steps in the acquisition of a major system, identifies significant legal and policy considerations in the development and production of a system like the Enforcer.

(1) DETERMINATION AND APPROVAL OF A MISSION NEED

Should the Air Force perceive a mission need requiring acqisition of a new weapon system, it must identify and submit a description of that need to the Secretary of Defense. Need is assessed on the basis of a deficiency in existing or projected capabilities or technological or cost reducing opportunities. If approved by the Secretary of Defense, the Air Force is directed to explore alternative solutions to the mission need (OMB Circular A-109).

(2) EXPLORATORY DEVELOPMENT

The Air Force is required to solicit alternative design concepts from a broad base of qualified firms. (OMB Cir A-109, p. 8). This is required "to gain the benefits of industry innovation and competition and not be constrained by preordained or prematurely selected equipment" (OFPP Pam A-109, p. 12). This phase ". . . shall emphasize competition to select the best possible solutions from industry, academic and government sources. . . ." (DODD 5000.2, IV.E.d. See also DODD 5000.1, IV.H). Those sources offering the most promising system design concepts for further exploration are selected for award of parallel, short term, system design concept contracts. In certain circumstances, solicitation may be limited to a single source. However, in view of the policy goal of broad based industry participation through competition, solicitation of a single source is highly circumscribed. It is authorized for research and development when (1) a thorough technical evaluation of potential sources demonstrates that only one source is fully qualified to perform the proposed work; (2) the purpose of the contract is to explore an unsolicited proposal which offers significant scientific or technological promise, represents the product of original thinking and was submitted in confidence; (3) the purpose of the contract is to take advantage of unique and specific industrial accomplishment by a specific concern. See ASPR 4-106.1 and .2.

Digitized by Google

(3) DEMONSTRATION

On the basis of the results of the parallel system design concept contracts, those concepts offering the most confidence are selected for competitive demonstration, leading to full scale development. The demonstration should involve competing concepts unless (i) only one system design concept contract had been previously awarded or (ii) all but one of the competing design concepts was eliminated as a result of evaluation of the progress and the risks identified by the parallel system design concept contracts.

(4) FULL SCALE DEVELOPMENT

Procurement policy expressly recognizes that, "once demonstration has verified that the chosen system design concept(s) is sound and the risks are acceptable—competition between similar or differing system design concepts may be extended throughout the entire acquisition process whenever it is economically beneficial to do so. Thus, contractors who successfully demonstrate their design concepts may be awarded contracts for subsequent full scale development." (OFPP Pam. A–109, p. 19). Defense directives mandate that the use of parallel development of competitive prototypes, alternative systems, and the encouragement of multiple production sources should be fully explored in soliciting offers. (DODD 4105.62, p. 3).

(5) PRODUCTION

The process of eliminating possible solutions to a mission need involves a "progressive narrowing of participating contractors" (OFPP Pam. A–109, p. 20). Should a decision be made to produce a particular system, Defense policy and procurement regulations still require competition whenever practicable. (DODD 4105.62, p. 3.). However, at the time of this decision, the factual circumstances surrounding the purchase may indicate that procurement from a single source is appropriate because of unique qualifications and capabilities. This is recognized at 10 U.S.C. 2304(a)(10), as implemented by ASPR 3–210 and 10 U.S.C. 2304(a)(14), as implemented by ASPR 3–214 which authorize the negotiation of production contracts with a single source under certain circumstances.

In our view the system acquisition process as defined by statute, executive policy, departmental directives and regulations, while authorizing procurement from a single source under certain circumstances, requires competition to the maximum practicable extent consistent with the nature of the procurement throughout the acquisition process. This requirement is placed not only on the contracting officer in the proper exercise of his contracting authority, but also on the program manager in his capacity as the individual responsible for achieving program objectives. The program manager is expressly required to manage the program in a manner that includes maximum use of effective competition throughout the course of the acquisition process (DODD 5000.1, page 6).

Thus, with regard to the acquisition of a system like the Enforcer, industry wide competition would be required consistent with the above authority and directives.

Senator GOLDWATER. General Slay, if Air Force wanted this aircraft—if the Secretary or Chief of Staff directed it, or the Secretary of Defense ordered it, how long would it take?

General SLAY. Based on our recent experience with the F–15, A–10 and F–16 programs, full scale engineering development and test of the Enforcer would take approximately 2 years after a Secretary of Defense decision to proceed. Assuming we encountered no development, test or evaluation problems, the next milestone would be a productiotn decision. Initial production configuration aircraft deliveries would begin approximately 2 years later. An initial operational capability (IOC) would be attained about 1 year after initial deliveries since unit equippage, supportability and training are the pacing items for achieving IOC.

In summary, an IOC for the aircraft would take approximately 5 years from a Secretary of Defense decision to acquire the aircraft.

Senator GOLDWATER. Explain to the Committee how Air Force determined that it would take approximately 800 Enforcers to kill the same number of tanks that approximately 500 A–10s could kill. Were there survivability statistics in that analysis?

General SLAY. Those results were from an Air Force analysis which was presented to this Committee during hearings on Enforcer on 29 and 30 July 1975.

The analytical methodology has been used for most of our A–10 studies in addition to the Enforcer-A–10 comparison. It is the same methodology scruti-

Digitized by Google

nized by the GAO before they accepted our A–10 effectiveness and survival results as the basis for some A–10 work of their own.

In the methodology, survivability statistics are derived from computer models which dynamically account for such effects as presented and vulnerable areas for both aircraft, aircraft tactics and performance, the performance of enemy air defenses (surface-to-air missiles, antiaircraft guns and interceptors), weather and the use of defense suppression systems. In addition to survivability, the models also compute expected battle damage. Subsequent calculations use the battle damage information along with Enforcer and A–10 characteristics to compute expected combat sortie rates, while still other calculations estimate the effectiveness of each aircraft in terms of tanks killed per sortie. Considering the survival of each force, the number of sorties flown, and the number of tanks killed per sortie, a force of 888 Enforcer aircraft was required to equal the tank-killing capability of 504 A–10s.

Senator GOLDWATER. What is the manufacturing cost per pound of the A–10? Does measuring the cost of an aircraft in this manner have merit?

General SLAY. In FY 1970 dollars based on 733 aircraft the cost is about $81 per pound. As with all cost analysis relationships, "Cost per Pound" has merit only when understood in strict context since the cost figure is sensitive to such factors as airframe complexity, cost of materials, and manufacturers efficiency and labor and overhead costs. A complex aircraft may be expected to cost more than a simple one, exotic materials are generally lighter and more expensive to procure and fabricate than aluminum and steel, and precisely the same aircraft manufactured in two different locations can vary significantly in cost. Traditional cost estimating relationships based on physical characteristics such as weight are considered valid methods for estimating certain weapon systems costs in the conceptual and advanced development phases. However, once actual cost experience is available, the traditional methods are replaced with costing methodologies tailored to use actual cost data.

Senator GOLDWATER. The Air Force is on record to agreeing with the claims made by Mr. Lindsay for Enforcer's performance. Yet Mr. Lindsay says an operational test is needed. What additional data could be gained from an operational test?

General SLAY. In our opinion very little would be gained from an operational test. The Air Force is on record as agreeing with the aerodynamic performance claimed for the Enforcer. Consequently, we believe a flight test to show its aerodynamic performance is unnecessary. With regard to support and maintenance factors (e.g., turboprop aircraft characteristics, reliability, maintainability, etc.) we could obtain added experience for estimating life cycle costs, however, we have substantial experience in similar aircraft which can be used to predict Enforcer operational characteristics. USAF and Navy/Marine Corps A–1 Skyraider and OV–10 Bronco experience, as well as USAF F–51 experience form a baseline for predicting propeller aircraft combat capabilities in terms of formation flying, tactics, turn-around times, operations from forward operating bases, operational procedures, etc. The Enforcer's predicted maneuverability is somewhat similar to the A–10's, thus our very successful operational tests of the A–10 at Fort Polk, Louisiana; McChord AFB, Washington; Gila Bend, Arizona; and Nellis AFB, Nevada have given us excellent standards for comparing close air support aircraft capabilities.

In summary, what little we do not already know about Enforcer's characteristics, both technical and operational, we can predict confidently based on our experience with similar systems. Thus, we believe very little additional data could be gained from an operational test of the Enforcer.

Senator GOLDWATER. Would an operational test help establish life cycle costs through finding out maintenance manhours per flight hours?

General SLAY. Yes. An operational test would certainly provide added maintenance experience for estimating life cycle cost.

Senator GOLDWATER. Did Air Force use life cycle costs of the Enforcer in comparing it to the A–10 in previously referred to study?

General SLAY. Yes. We did estimate life cycle costs, which are the sum of research, development and procurement costs and operating and support costs, for both aircraft over a 15-year operational life.

Senator GOLDWATER. Mr. Lindsay has indicated his belief that we have or will reach the point in conducting close air support that greater numbers of systems will be needed in order to saturate the defenses. Otherwise, a few systems, no matter how good will not survive. What is your comment to that?

Digitized by Google

General SLAY. We do not plan to be in a situation where only a few systems will be employed. Our tactical fighter force will number several thousand. When combined with other NATO air/ground forces, our aggregate capability, in a defense posture, will be difficult to overcome.

The A–10 is testimony to Mr. Lindsay's concept. We seek to buy large numbers of relatively inexpensive systems. However, we feel that the A–10 when employed with our other weapon systems represent the proper balance of qualitative capability and force levels which yield the best overall close air support capability.

In those instances where saturation of enemy defenses is required, we are either procuring or developing systems that will provide that capability. Saturation is only one way to dilute and suppress defenses. Systems designed for saturation/confusion include: countermeasure pods (electronic/infra-red/electro-optical), chaff (bundles, bombs, dispensers), infra-red flares, expendable drones (Tractical Expendable Drone System, Harrassment Vehicle), recoverable RPVs, and the EF–111A Tactical Jamming System. Other systems are designed to locate and destroy enemy defenses.

Senator GOLDWATER. How would you defend aaginst a force of Enforcers in a close support scenario?

General SLAY. I don't believe I would defend against Enforcers any differently than I would against other Close Air Support (CAS) aircraft. The same anti-aircraft defenses will be a threat to the Enforcers. The deployment of a modern air defense system will require the Enforcer to carry the same self protection equipment now planned for other CAS aircraft. This includes a radar warning receiver, infrared countermeasures flares, chaff and electronic countermeasures pods. These additions can be accommodated on the Enforcer but it requires a substantial reduction in the Enforcers' payload. Because of the Enforcers' small size and correspondingly smaller payload these additions have a greater impact on its overall effectiveness.

Senator GOLDWATER. Do you believe it is fair to compare the Enforcer to the loss rate and vulnerability of the F–51 which saw its last combat in Korea and the A–1 which last flew in Vietnam? If so, why?

General SLAY. I do not believe it would be appropriate to compare the Enforcer to the loss rate and vulnerability of the F–51 in Korea and A–1 aircraft in Vietnam. To the best of my recollection, the Air Force has not made such a comparison; however, we have made an analytical comparison of the Enforcer attrition relative to the A–10 and the Enforcer vulnerability relative to the A–7D and A–10. These comparisons were presented by Lt. Gen. Stewart in the 30 July 1975 Enforcer hearing before the R&D Subcommittee, and we believe they are accurate.

Senator GOLDWATER. General Stewart in briefing the R&D Subcommittee at the Enforcer hearing said:

Survivability considers both the probability of being hit and the probability of loss, if hit. (p. 94)

General STEWART then says:

In essence what this chart says is that the proposed Enforcer is *less* vulnerable than the A–7 and more so than the A–10.

Are you familiar with that chart? Does Air Force still stand by that chart?

General SLAY. Yes, sir, we do.

Senator GOLDWATER. General Slay, the Subcommittee asked earlier this morning to provide an A–10 ROC (Required Operational Capabilities) or RAD (Requirements Action Directive). Were you able to find that document? The purpose of this question is for you to examine that document and tell the Subcommittee whether the Enforcer meets the requirements of that document.

General SLAY. In general, the Enforcer could meet the requirements of the A–X Requirements Action Directive (RAD). At the same time it should be recognized that this document was prepared over 10 years ago. However, an aircraft which meets only A–X RAD requirements would not meet the mission requirements of today. For example, both the threat and mission tasks originally envisioned for the A–X have changed. The increased magnitude and sophistication of the threat have required additional operational capabilities. These additional capabilities are not included as amendments to the original RAD, instead they are identified and documented as Required Operational Capabilities or ROCs and incorporated on aircraft through Program Management Directives (PMDs). A prime example is the need for self protection equipment such as radar warning gear, chaff/IR flare dispensers, and ECM. Because of the Enforcer's relatively small payload such additions might have a greater impact on

Digitized by Google

the ordnance and fuel load which can be carried. Also, the RAD did not require the gun lethality necessary to defeat current and projected armored targets. The successful development of the GAU–8 gun system made it an attractive, combat effective addition to earlier stated requirements. The operational utility and effectiveness of the 106mm recoilless gun and DEFA 30mm gun pod, proposed for the Enforcer, are inferior to the A–10/GAU–8 30mm weapon system. The A–10 has a demonstrated operational capability which meets our current requirements. The Enforcer's projected capabilities fall short of our current and anticipated needs.

Senator GOLDWATER. Last week in a joint Army/Air Force Subcommittee hearing, we were told that in the early 80's based on current preparations the Warsaw Pact forces will have us and our allies outnumbered [deleted] in tanks, [deleted] in artillery tubes, [deleted] in APC's, [deleted] in combat helicopters, [deleted] in counter air, [deleted] in recce and [deleted] in medium bombers. Based on those projections, is it not in our best interest to try and develop more affordable systems that can cut down on this deficit?

General SLAY. Not necessarily, sir, the force imbalances cited in the briefing are the basis for our force planning. If we were fiscally unconstrained, we would buy more weapons. Our force planning documents reflect our assessment that substantially higher levels are required to counter the threat at minimum risk. If we could afford these higher force levels, they would include the same qualitative mix of systems we are asking for in this year's budget request but more of them.

We can no longer match the Warsaw Pact on a system for system basis. Instead, our proposed force structure reflects what we feel is the optimum mix of primary and support systems which will yield the best overall aggregate capability to counter the threat. Our planned improvements include systems designed to maximize the application and survivability of our numerically smaller force. Several examples of these capability enhancements include: AWACS, improved recon/intell systems, the Precision Location Strike System (PLSS) and the EF–111 tactical jamming system.

When these capability enhancements are applied in integrated air/land operations, we will be able to match the pace of the threat and continue to carry out our mission in Central Europe.

Senator GOLDWATER. What can you tell the Subcommittee, recognizing we are in open session, about the projected capability of the A–10 force for the 1980 time period to cope with the large number of Warsaw Pact tanks?

General SLAY. The threat of the large number of Warsaw Pact tanks must be countered by NATO's combination of air and ground anti-tank defenses. These elements must react, in concert, depending upon the size, location and timing of hostilities. As far as air anti-tank operations are concerned, the A–10 is the most capable tank killer in our inventory. It was designed specifically for the close air support role, of which anti-armor is an important part. In comparison to our present F–4 and A–7 capability, the A–10 is projected to be well over [deleted] as effective in the day but, more significantly, many times more effective during adverse weather operations. Specifically, the A–10 force, programmed to be available in Central Europe during the 1980s, could account for over [deleted] percent of the armored fighting vehicles destroyed by NATO tactical air.

Senator GOLDWATER. What percentage is expected to be killed by air versus by ground forces?

General SLAY. Past studies addressing this subject indicated that between [deleted] percent would be killed by air forces. These studies are dated and did not consider recent improvements in aircraft and anti-tank munitions. The Air Force hopes that ground forces can meet the bulk of the tank threat. As I have stated in previous testimony, the most cost effective way to kill a tank is for a soldier to climb on the turret and drop a grenade down the hatch. From that point, the cost effectiveness equation gets more complicated. But when you look at the potential threat across the entire European front, ground forces are hard pressed to cope with the number of tanks that could be thrown against them. This is where aircraft such as the A–10 become important. The inherent flexibility of tactical air allows you to mass firepower against buildup and potential breakthrough areas. This becomes particularly important if a breakthrough occurs in a defense deficient area. The Air Force is devoting extensive attention to this problem of aiding the ground force in just this situation. We have developed the A–10 specifically for that job. We believe we will have the potential to kill a high percentage of the tanks facing friendly forces.

Senator GOLDWATER. What capability will the A–10 have to kill the Hind helicopter?

Digitized by Google

General SLAY. The A–10 will have the capability to attack and destroy the Hind and other threat aircraft on the ground by strafing them with the GAU–8 30mm gun, using area munitions such as Rockeye, or standoff weapons such as the Maverick missile. In an airborne encounter, the A–10's most effective weapon against a helicopter would be the GAU–8. While there is no lead computing gun sight on the A–10, the GAU–8, with its high velocity, flat trajectory 30mm round, has been successfully test fired during maneuvers exceeding 5 Gs. This fact, coupled with the relative speeds of the two aircraft, gives the A–10 a degree of air-to-air capability against the Hind.

QUESTION SUBMITTED BY SENATOR HOWARD CANNON

(Question submitted by Senator Howard Cannon, answer supplied by General Slay:)

Senator CANNON. General Slay, what is the impact of a full ordnance load on the performance capabilities of the Enforcer?

General SLAY. I will discuss the impact of a heavy bomb load on the Enforcer's performance capabilities in terms of maneuverability, range and speed. The load we evaluated is equivalent to approximately 4300 lbs. The impact on maneuverability of adding payload to the Enforcer is shown in Figures 1 and 2 and is summarized in the following table:

	S/L, standard day, 250 kts	
	Sustained load factor (g's)	Instantaneous load factor (g's)
Clean, full internal fuel	3.5	5.2
6 MK-82's, 2 ECM pods (350 lbs each) 600 lb ammunition	2.2	3.7

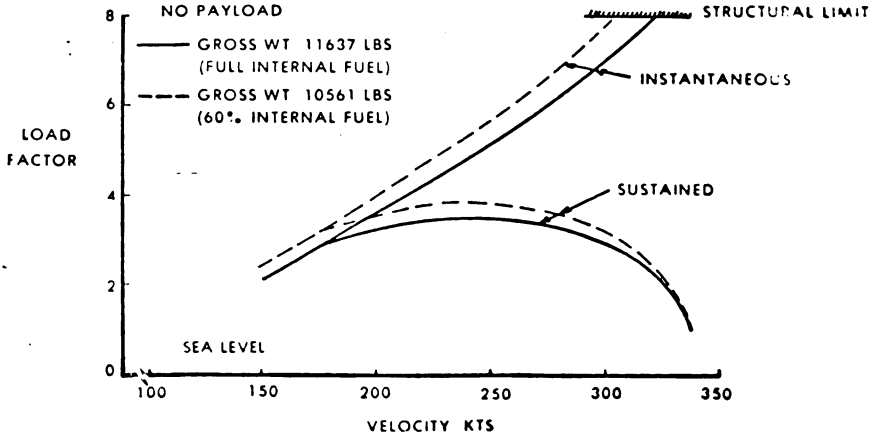
Thus a relatively small payload has a significant impact on the maneuverability of the Enforcer.

The addition of six (6) MK–82 bombs to a clean aircraft reduces the Vmax at 5000 feet MSL from approximately 350 kts to 325 kts.

The Enforcer, fully loaded with external fuel and 4 MK–82 bombs, has a radius of 500 nm with a 1 hour loiter reserve. If the bomb load is increased to 6 MK–82 bombs, the radius decreases to 260 nm with a 1 hour loiter reserve.

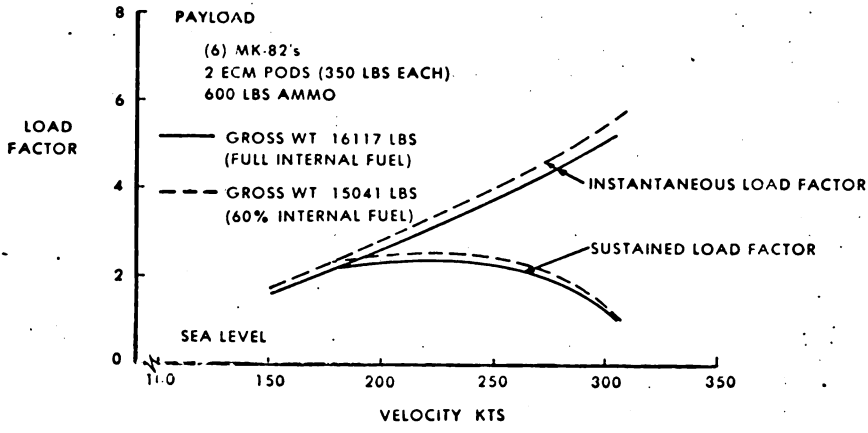
LOAD FACTOR CAPABILITY

ENFORCER AIRCRAFT



Digitized by Google

LOAD FACTOR CAPABILITY
ENFORCER AIRCRAFT



Mr. CROMWELL. This concludes the Tactical Air Subcommittee's regularly scheduled hearings for this year, and the subcommittee will stand in recess subject to the call of the Chair.

[Whereupon at 1:30 p.m. the subcommittee adjourned, subject to the call of the Chair.]

Digitized by Google

Digitized by Google

Digitized by Google

Digitized by Google

DATE DUE			

STANFORD UNIVERSITY LIBRARIES
STANFORD, CALIFORNIA 94305-6004

Digitized by Google

Digitized by Google